Colorado River Basin Salinity Control Program
Federal Accomplishments Report for Fiscal Year 2016

Presented to

Colorado River Basin Salinity Control
Advisory Council

by

United States Department of Agriculture
Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey
Bureau of Land Management
Bureau of Reclamation

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Colorado River Basin Salinity Control Program
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Acronyms and Abbreviations

Advisory Council	Colorado River Basin Salinity Control Advisory Council
ASCS	Agricultural Stabilization and Conservation Service
Basinwide Program	Basinwide Salinity Control Program
BLM	Bureau of Land Management
BSP	Basin States Program
CAP	Central Arizona Project
CRBSCP	Colorado River Basin Salinity Control Program
CRSS	Colorado River Simulation System
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FAIRA	Federal Agricultural Improvement and Reform Act
FOA	Funding Opportunity Announcement
Forum	Colorado River Basin Salinity Control Forum
FSRIA	Farm Security and Rural Investment Act
FY	Fiscal Year
GGNCA	Gunnison Gorge National Conservation Area
GIS	Geographic Information System
HDB	Hydrologic Date Base
NCA	National Conservation Area
NIWQP	National Irrigation Water Quality Program
NRCS	Natural Resources Conservation Service
Reclamation	Bureau of Reclamation
RMP	Resource Management Plan
Service	U.S. Fish and Wildlife Service
TDS	Total Dissolved Solids
TMS	Technical Modeling Subcommittee
USDA	United States Department of Agriculture
USGS	U.S. Geological Survey
UVWUA	Uncompahgre Valley Water Users Association
Work Group	Colorado River Basin Salinity Control Forum's Work Group

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U.S. Department of Agriculture (USDA)
Natural Resources Conservation Service (NRCS)

Colorado River Basin Salinity Control Program (CRBSC)
Accomplishments for Fiscal Year 2016

The NRCS of the USDA conducts CRBSC activities primarily under the authorities of the Environmental Quality Incentives Program (EQIP). EQIP was authorized by the 1985 Food Security Act (1985 Farm Bill) but received its first appropriation with passage of PL104-127, Federal Agricultural Improvement Act of 1996, a.k.a. "1996 Farm Bill."

EQIP has been reauthorized three times; (1) PL 107-171, The Farm Security and Rural Investment Act of 2002, (2) PL 110-246, The Food, Conservation, and Energy Act of 2008, and most recently (3) PL 113-79, The Agricultural Act of 2014, known as the 2014 Farm Bill, enacted February 7, 2014.

Through EQIP, NRCS offers voluntary technical and financial assistance to agricultural producers, including Native American tribes, to assist decision-makers to install conservation practices that correct environmental problems and that meet their environmental goals. Within the twelve salinity project areas, producers may be offered additional financial incentives and technical assistance to implement salinity control measures with the primary goal of reducing offsite and downstream damages to the Colorado River and its tributaries and to replace wildlife habit impacted as a result of the salinity measures.

In fiscal year (FY) 2016, about $10.7 million of appropriated-EQIP financial assistance funding was obligated into new EQIP contracts for salinity control and wildlife habitat as follows:

Obligation	
Colorado -	[1] $4,979,966
Utah -	$5,044,294
Wyoming -	$160,814
Totals	$10,185,074

[1]Colorado's total includes $300,000 obligated into Tier II areas including the completed Grand Valley Unit that were associated with the Bureau of Reclamation's WaterSmart Program. Utah and Wyoming did not obligate any salinity EQIP funds into Tier II areas.

Program History

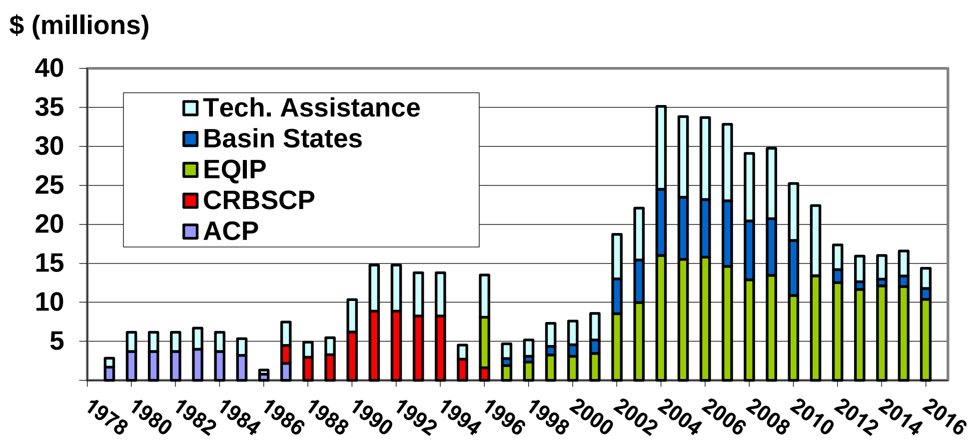
Progress in implementing the various projects is controlled primarily by annual federal appropriations. The Salinity Control Act provides funds for additional implementation from the Basin States Salinity Program. From the 1970s through 1986, the Agricultural Conservation Program (ACP) administered by the Agricultural Stabilization and Conservation Service (ASCS) provided financial assistance (cost share) to land users through long term agreements (LTAs) and the Soil Conservation Service (SCS) provided the technical assistance to plan, design, and certify practice implementation. From 1987 through 1996, the Colorado River

Salinity Control Program (CRSCP) received dedicated annual funding, again with the ASCS administering the financial assistance and SCS providing the technical assistance. In 1995, Public Law 103-354 authorized the reorganization of several agencies of USDA. The ASCS was reorganized as the Farm Service Agency. The SCS was reorganized as the NRCS. Financial administration of the CRSCP was transferred to the NRCS where it has remained to the present.

The Federal Agricultural Improvement and Reform Act (FAIRA) of 1996 (Public Law 104127) combined four existing programs including the CRBSCP into the newly authorized EQIP. Since the 1996, EQIP has been reauthorized through four consecutive farm bills and is currently authorized through FY 2018.

In FY 1997, Reclamation began on-farm cost sharing from the Basin States funds that would parallel and supplement the EQIP.

Figure 1 - On farm/Near farm Allocations



Monitoring and Evaluation

NRCS personnel from project and area offices monitor and evaluate the effectiveness and quantity of salinity control, wildlife habitat, and economic trends in order to improve overall performance and management of the program. The program continues to function effectively and economically, though the nominal cost per ton of salt control is escalating in some areas. The Monitoring and Evaluation Reports for FY 2016 can be found at: http://www.usbr.gov/uc/progact/salinity/index.html

Status of Planning and Implementation

USDA-NRCS continues to provide technical and financial assistance to landowners and operators to implement on-farm salinity control measures in twelve approved project areas in three Upper Basin states.

Grand Valley, Colorado

Implementation has been underway in this unit since 1979 and NRCS considers that the salt control measures of the project have been successfully completed as planned. In 2010, a status report was compiled from field visits and observations. The report indicated that at least 12,000 irrigated acres are no longer in agricultural production. Of the remaining 44,700 acres still in production, 42,435 acres or 95 percent had received varying levels of treatment. As of September 2016, 19 additional contracts have been approved for $740,807 that will control 399 tons at a cost of $186 per ton.

Approximately 400 acres of additional habitat replacement on five parcels got underway in 2014. The habitat replacement consists of removal of woody, invasive vegetation with at least one follow-up treatment to control regrowth and sprouts. Planting of desirable native vegetation has also been completed. This project was funded by the Basin States Program and is projected to cost about $600,000 when completed in 2017.

Lower Gunnison Basin, Colorado

This project, which began in 1988, encompasses the irrigated farmland in the Gunnison and Uncompahgre River valleys. With the expansion into the upper headwaters of the Uncompahgre River in 2010, implementation continues in Delta, Montrose, and Ouray Counties. Nearly 60 percent of the salt control goal has been achieved.

Interest remains high in the project area particularly in those service areas that were awarded Reclamation grants for irrigation infra-structure improvements. Nearly $3.7M of EQIP was obligated into 56 new contracts with plans to control an additional 2,567 tons of salt on 1,891 acres. Currently, one Regional Conservation Partnership Program (RCPP) grant has been awarded within the project area and is starting to implement measures, some of which will create salt control.

Four new wildlife projects on 87 acres were funded in the Lower Gunnison Project area at a cost of $171,228.

Mancos Valley, Colorado

This project, near the town of Mancos, Colorado, was initiated and approved for funding and implementation by USDA-NRCS in April 2004. In 2016, two new EQIP contracts were developed for $21,879 to control 18 tons of salt.

McElmo Creek, Colorado

Implementation was initiated in this unit in 1990. Application of salinity reduction and wildlife habitat replacement practices continue to be implemented in this area with sprinkler systems, underground pipelines, and gated pipe being installed. In 2016, 21 new contracts were developed for $430,277. These contracts will provide 428 tons of salt control when fully implemented.

Manila-Washam, Utah

Three new contracts were developed in 2016 by the Vernal Field Office staff. These three contracts for $485,156 will control 584 tons.

Uintah Basin, Utah

Implementation began in this unit in 1980. The original salt control goal was reached several years ago but about 60,000 acres might still be improved. This project obligated more contracts than other projects in Utah. Producer participation is exceeding the original projections. As of early September, there were 35 new contracts reported. These contracts obligate about $1.8M to control about 827 tons of salt. There was one new wildlife habitat contract developed on 11 acres in the Uintah Basin.

Price-San Rafael, Utah

In early September 2016, 28 new contracts were either approved or pre-approved for a sum of about $2M. When implemented, these measures will control about 2,859 tons. The installation of the next phase of the Cottonwood Creek Irrigation Company's pipeline projects has generated quite a few new applications for the EQIP. The Huntington-Cleveland Irrigation Company's service area has reached about 98 percent treatment with only 200 acres or so remaining to be treated. One new wildlife contract was developed on 4.8 acres in the project area.

Muddy Creek, Utah

There was one new contract in the project for 2016 for about $398,000 that will control 270 tons of salt.

Green River, Utah

There were two new contracts in the project area in 2016 for $345,000. When implemented, these contracts will control about 745 tons. NRCS is completed renovation of the Tusher Diversion, the major diversion structure across the Green River that was damaged in 2012. The successful completion of the construction may spur on-farm applications in future years. Significant new lands are being brought under irrigation on the bench east of the Green River. As many as 200 center pivots may eventually be installed. None of these practices receive incentives from the salinity control program.

Big Sandy River, Wyoming

Implementation has been underway in this unit since 1988. Approximately 13,650 acres of the planned 15,700 acres have been treated (87 percent) and about 70 percent of the salt control goal has been reached. Producers also report that the water savings from improvements in irrigation systems now allows a full irrigation season of water for the entire irrigation district. There were no new contracts in 2016. An interagency review team plans to conduct a sampling of habitat replacement in mid-September to determine if the habitat replacement continues to be

"concurrent and proportional" to the implementation of the salt control measures.

Henrys Fork (of the Green River), Wyoming

The Henrys Fork Project was officially adopted with the issuance of the Record of Decision, June, 2013. In 2016, one new project were funded in the Henrys Fork Project Area for a cost of $160,814. This new 100 acre sprinkler irrigation system will provide about 87 tons of new salt control at an annualized cost of $174 per ton.

San Juan Basin, New Mexico and Arizona

The San Juan River Dineh Water Users, Inc. (SJRDWU, Inc.) provides irrigation water to Navajo Nation farmers along the San Juan River from Farmington past Ship Rock, New Mexico. The SJRDWU, Inc. has been aggressive in seeking funding to upgrade its delivery system. While NRCS has never designated this area a salinity control project there is hope that the improvement of delivery infrastructure will spur on-farm irrigation improvements.

Areas Beyond Current Project Boundaries

Even though some relatively high salt loading basins exist in both Colorado and New Mexico, local sponsors have not yet been inclined to pursue a salinity project designation.

Colorado NRCS continues to have success in funding salinity control practices outside of its five designated project areas but within the Colorado River Basin. In 2016, 8 projects that will control 455 tons for an annualized cost of $154 per ton were approved.

Table 1 - Implementation Status (October 21, 2016)

			Irrigated Acres	Treated Acres	EIS Goal (tons)	On-Farm Controls (tons)	Off-Farm Controls (tons)	[1]Total Tons Controlled	Indexed Initial Cost per ton $	Nominal 2016 Cost per ton $
Colorado	Grand Valley	1977	44,600	42,934	132,000	136,801	6,768	143,569	52	101
	Lower Gunnison	1982	171,000	68,460	186,000	99,847	21,187	121,034	87	148
	McElmo Creek	1989	29,000	16,163	46,000	27,358	2,447	29,805	99	146
	Mancos Valley	2004	11,700	2,773	11,940	2,434	2,035	4,469	67	30
	Silt	2005	7,400	1,783	3,990	1,461	865	2,326	93	235
Utah	Uintah Basin	1982	226,000	159,190	140,500	139,907	9,135	149,042	177	106
	Price-San Rafael	1997	66,000	35,207	146,900	83,334	1,553	84,887	36	44
	Manila-Washam	2005	8,000	3,559	17,430	7,958	0	7,958	53	40
	Muddy Creek	2004	6,000	70	11,677	71	0	71	96	n/a
	Green River	2009	2,600	399	6,540	1,287	0	1,287	104	37
Wyoming	Big Sandy River	1988	18,000	13,663	83,700	58,293	0	58,293	40	86
	Henrys Fork	2013	20,700	103	6,540	89	0	89	236	161
Tier II	(all)					6,558	964	7,522		
Totals			611,000	344,304	793,217	565,398	44,954	610,352		

[1]includes BSP projects not selected through FOA.

Have achieved 77 percent of goal of 793,217 tons.

Environmental Protection Agency (EPA)
Colorado River Basin Salinity Control Program
Fiscal Year 2016

During FY 2016, EPA continued to provide coordination and assistance to the Colorado River Basin Salinity Control Forum and Advisory Council involving salinity control activities. Several key items;

- The renewed Colorado River Basin Salinity Control Advisory Council Charter was signed by the EPA Administrator on August 1, 2016.

- EPA provided informational updates to the Forum and Advisory Council including updated State and Tribal Water Quality Standards and related program information.

- EPA Region 8 has continued the lead role for EPA Regions 6 and 9 for coordination with the Forum and Advisory Council and continues to be available for responding to questions, requests, and other needs.

- EPA Water program staff, including permitting staff from the three EPA Regional Offices, provided updates and input (questionnaire) to the workgroup preparing the 2017 Review of the Water Quality Standards for Salinity in the Colorado River System.

- EPA continues to participate as a Cooperating Agency in the Bureau of Reclamation's effort to prepare an Environmental Impact Statement (EIS) for the Paradox Valley Salinity Control Unit. The Regional Salinity Control Coordinator as well as Underground Injection Control program and National Environmental Policy Act (NEPA) staff are actively participating in this important effort.

The attached table indicates the current status of all the Colorado River Basin States in adoption of the Colorado River Basin Control Forum's salinity standards (Policies and Plan of Implementation).

EPA has approved the applications of five Tribes within the Colorado River basin for "treatment in a manner similar to a state" (TAS) to administer the Water Quality Standards (WQS) and §401 Certification programs on their respective tribal lands, and four tribes have approved WQS. Specifically;

• The WQS for the **Ute Mountain Ute Tribe** were approved by EPA Region 8 on October 19, 2011. It is anticipated that over the next year the Tribe will do a WQS triennial review. The Tribe has salinity and selenium (Se) standards and has several on-going Se and salinity projects examining potential effects on groundwater, irrigation and endangered species in Tribal and downstream waters.

• The **Hualapai Tribe** adopted revised WQS in July 2009, including the 2008 Forum

Policies and Plan of Implementation. These revised standards were approved by EPA Region 9 September 25, 2009.

• The **Navajo Nation** adopted revised WQS in May 2008 that included the 2005 Forum Policies and Plan of Implementation; the revised WQS were approved by EPA in March 2009. They have developed draft WQS that refer to the 2011 Forum WQS and conducted their public process on this revision but have not yet completed their action to adopt.

• The **Hopi Tribe** included the 2005 Forum Policies and Plan of Implementation in WQS revisions which were adopted by the Tribe March 21, 2011, and approved by EPA August 24, 2011.

• The **Havasupai Tribe** received its TAS approval on April 26, 2011; EPA Region 9 is working with the Tribe in completing development of their WQS.

The adopted and approved WQS for the four Tribes have been published and are available for review on-line.

The **Southern Ute Tribe** has submitted their WQS TAS application this past year. It is currently under review. If/when their WQS TAS application is approved, they will hold another WQS hearing, and submit to EPA for CWA action. If/when approved, their WQS will also become a part of the Forum's review.

COLORADO RIVER BASIN SALINITY CONTROL STANDARDS UPDATE

Basin States Adoption of Salinity Standards & Plan of Implementation Updates

September 2016

EPA Region – State	**2005 Update Adopted[1] by State**	**2005 State Adoption Approved by EPA**	**2008 Update Adopted[1] by State**	**2008 State Adoption Approved by EPA**	**2011 Update Adopted[1] by State**	**2011 State Adoption Approved by EPA**	**2014 Update Adopted[1] by State**	**2014 State Adoption Approved by EPA**
R9 – Arizona	Yes 12/02/08	Yes 1/21/09	In draft	--	In draft	--	Partial[2] 8/15/14	
R9 – California	Yes 2/01/06	Yes 3/16/06	Yes 8/04/09	Yes 3/09/10	In draft	--	Yes 5/05/15	
R9 – Nevada	Yes 9/06/06	Yes 4/05/07	Yes 10/05/10	Yes 6/15/11	Yes 10/11/12	Yes 2/12/13		
R8 – Colorado	Yes	Yes	Yes 12/08/08	2005 adoption reaffirmed	Yes 12/12/11	2008 adoption reaffirmed	Yes 12/8/14	
R8 – Utah	Yes 10/22/08	Yes 9/30/09	Yes 10/22/08	Yes 9/30/09	Yes 4/1/12	Yes 11/20/12	Partial[3] 8/15/14	

R8 – Wyoming	Adopted by reference – Water Quality Rules and Regulations (1982)						Yes[4] 3/23/15	
R6 – N. Mexico	Yes – by reference in WQS	Yes	Earlier version not changed	April 2011	Earlier version not changed	Previously approved with adoption by reference	Partial[5] 9/13/15	

[1] Adopted/Approved – Some states chose not to adopt Forum Standards during previous review periods because the salinity standards had not changed significantly.
[2] Incorporating the 2014 Review, but haven't completed its AG certification.
[3] 2014 Review released for public comment.
[4] Adopted criteria and (by reference) the implementation policies in State permit regulations.
[5] 2014 Forum Review referenced on State web site.

Fish and Wildlife Service (Service)
Colorado River Basin Salinity Control Program
Fiscal Year 2016

During FY 2016, the Service continued to provide coordination and assistance to the Colorado River Basin Salinity Control Forum and Advisory Council involving salinity control activities. We look forward to providing the same coordination in FY 2017.

Summary of 2016 Fish and Wildlife Activities-At a Glance

1. Meeting attendance

   a. Forum, Workgroup, and Advisory Council
      Tucson, AZ 10/26-29, 2015
      Phoenix, AZ 2/17-19, 2016 call-in
      SLC, UT 4/11-13, 2016 call-in
      Keystone, CO 6/6-9, 2016
      Cheyenne, WY 8/31, 2016 call-in
      Future meeting Moab 10/26-29, 2016

   b. Paradox cooperating agency meetings
      06/01/16

2. Environmental Document Review

   a. Environmental Assessments
      Zanni Lateral of the Crawford Clipper Ditch Pipeline Project

   b. Biological Opinion
      Zanni Lateral Pipeline Project

   c. Informal consultation
      Grand Junction Wildlife Area Tree Thinning Project

   d. Informal consultation
      Delta Duck Club- wildlife replacement project for NRCS

   e. Reviewed draft report and provided comments, and coordinated comments with EPA for-- "*Predictive Ecological Risk Assessment Proposed Solar Evaporation Pond System, Paradox Valley Unit*".

3. Wildlife Replacement Activities

   a. Track progress on wildlife replacement projects/Basin States funded
      - Olathe pond wildlife replacement project
      - Grand Valley wildlife replacement project

Coy-Eden wetland loss-Evaluate Big Sandy SCU
Henry's Fork instream wildlife replacement projects
Discussions of wildlife replacement on BLM land

b. Approvals for wildlife habitat replacement projects associated with the following salinity control projects:

    - Grand Valley SCU, Colorado
        - C ½ Road CPW project
    - Lower Gunnison SCU, Colorado
        - North Delta Pipeline Project
        - Offsite replacement project in Paradox Valley
        - Delta duck club
    - Blacks Fork SCU, Wyoming
        - Austin Canal Project
    - Price-San Rafael SCU, Utah
        - Mill Ditch Project
    - McElmo SCU, Colorado
        - Offsite replacement projects by Durango, CO
            - Koeberle
            - Rivera
            - Sullivan
            - Watson

c. Wildlife Replacement Project Site Visits

    - Grand Valley SCU
        - Grand Junction Wildlife Area
        - Horsethief State Wildlife Area

    - Lower Gunnison SCU
        - Delta duck club-site visit, and Yellow-billed cuckoo surveys by NRCS and FWS
        - Escalante State Wildlife Area-Roubideau ponds, Armory pond, 52 acre tamarisk removal site
        - Sites associated with following salinity control projects:
            - Rogers Mesa, C-Ditch, Grand view, Cattleman's Ditch, North Delta Piping Project

d. Review M&E reports for status of Wildlife Replacement Credits

4. Training
    a. Tamarisk Coalition Conference
    b. Assessment Proper Functioning Condition of Riparian areas
    c. Avian Habitat Project Development Strategies Meeting

Forum Meetings Attended

The Service salinity coordinator attended salinity work group and forum meetings during the past year in Tucson, AZ and Keystone, CO, and will be present at the upcoming forum and workgroup meetings in Moab, UT. She phone conferenced in on workgroup meetings in Phoenix, AZ, Salt Lake City, UT, and Cheyenne, WY when wildlife replacement topics were discussed. She represented the Service at the Paradox Valley Unit cooperating agency meeting in June. She has represented the Service at Se management program and Se task force meetings. She looks forward to continued involvement with the assessment of past and future wildlife replacement projects, as well as involvement with the environmental review of salinity control projects.

Environmental Review of Salinity Control Projects

Environmental Assessments

The Service salinity coordinator continues to be involved in the review of environmental documents associated with salinity control projects. She reviewed and prepared comments addressing the Environmental Assessment (DEA) for the Zanni Lateral of the Crawford Clipper Ditch Pipeline.

Endangered Species Act Section 7 Consultations

In accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et. Seq.), and the Interagency Cooperation Regulations (50 CFR 402), the Service salinity coordinator prepared a biological opinion for the Zanni Lateral of the Crawford Clipper Ditch Pipeline in the lower Gunnison SCU. She also provided comments regarding an informal consultation for the Grand Junction Wildlife Area Tree Thinning Project. Terry Ireland in the Grand Junction, CO Service office reviewed an informal consultation regarding the Olathe Pond wildlife replacement project.

The 2015 FOA resulted in seven salinity projects that were awarded funding in the lower Gunnison basin. Five agreements have been signed. Two agreements are reliant on RCPP funding, and still need to be signed. These projects will involve associated NEPA review and ESA section 7 consultations for future implementation.

Endangered Species Updates

Two new species were added to the endangered species list in 2014, and both of these species occur in the upper basin states of Colorado, Utah, and Wyoming. These species need to be considered in any environmental documents associated with salinity control projects and habitat replacement projects, including NEPA analyses, as well as in Endangered Species Act (ESA) section 7 consultations. This increases the complexity and time needed for environmental review of salinity control projects.

Western Yellow-Billed Cuckoo

The western yellow-billed cuckoo was placed on the endangered species list as threatened, on October 3, 2014. Revised critical habitat will be proposed this December, along with a minimum 30 day public comment period. A final critical habitat designation is expected the beginning of calendar year, 2017.

Critical habitat identifies the geographical areas containing features essential for the conservation of the species. The western yellow-billed cuckoo is a riparian obligate species historically known from parts of the 12 States west of the continental divide; including Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, and parts of Montana, Wyoming, Colorado, New Mexico, and Texas. The yellow-billed cuckoo is a secretive, robin-sized bird that breeds in willow and cottonwood forests along rivers and streams. It appears to require large blocks of dense riparian forested habitat consisting of older trees (typically cottonwood) with a vegetative understory component of shrubs and smaller young trees. It eats primarily large insects such as katydids, caterpillars, and cicadas. Biologists estimate that more than 90 percent of the bird's riparian habitat in the West has been lost or degraded as a result of conversion to agriculture, dams and river flow management, bank protection, overgrazing, and competition from exotic plants such as tamarisk and giant reed grass.

Designation of critical habitat does not affect land ownership or establish a refuge or preserve and has no impact on private landowners who are taking actions on their own property that do not require a Federal nexus such as through funding, permit, or authorization. Critical habitat designation does require Federal agencies that undertake, fund, permit, or authorize activities that may affect critical habitat are required to consult with the Service to ensure that such actions do not adversely modify or destroy that habitat. Salinity control projects or habitat replacement projects (such as non-native vegetation removal) that involve critical habitat of any size or riparian habitat that is potentially suitable for yellow-billed cuckoo nesting may need ESA section 7 consultation, which may include surveys for presence of yellow-billed cuckoos. Surveys that were conducted this summer on a potential habitat replacement site scoped by NRCS indicated the presence of two yellow-billed cuckoos. The Service will work with NRCS on this site and provide recommendations to avoid take during non-native vegetation removal, and avoid extreme habitat modification that would cause birds to avoid sites completely. The Service will continue to work with NRCS and Reclamation regarding yellow-billed cuckoo habitat in salinity control project areas and in wildlife replacement projects planned in Colorado, Utah, and Wyoming.

Gunnison Sage Grouse

The Gunnison sage grouse was listed as threatened on November 20, 2014, and critical habitat was also designated at this time. Sage-grouse are considered obligate users of sagebrush and require large, contiguous areas of sagebrush across the landscape for long-term survival. Loss and fragmentation of sagebrush habitats are chief causes in the decline of Gunnison and greater sage-grouse populations. The current range wide population is estimated at 4,705 birds across the seven population areas. The Gunnison Basin population contains over 84 percent of the total number of birds and constitutes the largest remaining population. The six satellite populations

are much smaller, isolated and are declining. The Gunnison Basin population trend has been stable over the same period. The range and critical habitat of the Gunnison sage-grouse overlaps with current and future potential salinity control project sites contained in the lower Gunnison SCU, and the PVU.

<u>Greater Sage Grouse</u>

A decision whether or not to propose listing the Greater sage grouse was officially made on Oct. 2, 2015, when the Service found that listing this species was not warranted at that time. The Service does request that the public provide any new information that becomes available concerning threats to this species or its habitat, and will review the status of the greater sage-grouse in five years. We therefore encourage continued implementation and development of formal conservation commitments across the range of the Greater sage-grouse. The Greater sage grouse is also a sagebrush obligate species. Priority areas of conservation for the Greater sage grouse overlap with salinity control units in Wyoming and Utah.

Environmental Documents-Depletions

A continued request from the Service is to have more explanation in environmental documents from Reclamation offices which better explain what happens to the water savings from reduced seepage associated with salinity control projects. Information that would be useful in documenting a determination of no new depletions include: no new land will be irrigated, no new water storage will occur, the growing season will not be extended, there will be no change in crop type (or if change in crops, they will require less water), and no additional water will be applied to existing crops (i.e., to get full water right). If there are reduced river diversions, than state this is so—(hopefully no problem with water rights if this is stated??). If increased tail-water at the pipe-end flows back into the river, it would actually be considered a beneficial effect; therefore, the Bureau could submit a concurrence for Not Likely to Adversely Affect (NLAA) rather than no effect.

Should it be determined that new water depletions will in fact occur with any salinity control project, section 7 consultations should be initiated with the Service. Because the Bureau contributes funds to the recovery program, there will be no requirement to pay a depletion fee for Bureau projects that exceed 100 acre-feet per year.

Paradox Valley Salinity Control Unit

The Service salinity coordinator reviewed the draft report "Predictive Ecological Risk Assessment Proposed Solar Evaporation Pond System, Paradox Valley Unit", and provided comments to the Bureau for review by their contractor, Amec Foster Wheeler. She also provided comments to EPA. We remain concerned that every minimization measure evaluated for the evaporation pond alternative presented by Amec Foster Wheeler is going to have some level of migratory bird take associated with it.

Wildlife Replacement Activities/Basin States funded

The Service truly appreciates the efforts of Bureau and NRCS staff to replace wildlife habitat values forgone.

Olathe Wildlife Replacement Project (lower Gunnison SCU)

The Service salinity coordinator followed up on the status of the proposed wildlife replacement project planned for the Olathe pond property. Basin states funding would be used for implementation of this project, because no farm ground is associated so it does not qualify for funding under EQIP. There are signed contracts by both the landowner and the Shavano Conservation District. The Service has completed a Sec. 7 consultation with the Bureau, and the Project proponents are waiting for a nationwide permit from the Army Corps of Engineers (COE).

The Bureau is waiting for a copy of the COE Preconstruction Notice (PCN) and a transmittal letter demonstrating that the PCN has been sent to the COE from the landowner. NRCS is assisting the landowner with the permit, so the Bureau is waiting to hear from NRCS. Once received, the Bureau can complete a categorical exclusion (CE) and route it for signature. The Bureau will then provide a copy of the CE to NRCS so that they in turn can give it to the COE. At this point, the COE should have all the material necessary to complete the permitting process. Once the COE issues their permitting letter and provides a copy to the Bureau, the Bureau can attach it to the CE, and provide to their Regional office who will give the go-ahead to release the funds.

This project would provide approximately 9-10 acres of wildlife habitat replacement credit for the lower Gunnison SCU. This project consists of protecting a 6-acre pond and improving wildlife habitat on private property adjacent to the Uncompahgre River, just north of Olathe, Colorado. The project involves pond protection by increasing the height of the berm and bank stabilization, non-native fish control structures to protect endangered fish critical habitat downstream in the Gunnison River from non-native fish in the pond, and riparian restoration by removal of non-native invasive vegetation and replanting native vegetation. It is estimated by NRCS that this project would provide about 9 to 10 acres of wildlife habitat that can be counted for replacement goals.

Grand Valley Wildlife Replacement Project (Grand Valley SCU)

The Service salinity coordinator continues to track progress on the Grand Valley Wildlife Replacement Project, which involves non-native vegetation removal at and habitat improvement at five Colorado Parks and Wildlife properties. Phase I of this project, that involved mechanical removal of Tamarisk and Russian olive, was started November 2014 and completed early March, 2015. Phase II of this project involves treatment of tamarisk resprouts with herbicide, and also herbicide applications to annual weeds. Phase II was started in the spring of 2015 at the five wildlife areas and areas were retreated in fall. These herbicide applications continued in the spring of 2016, and will continue this fall. Phase III of this project is revegetation, which was not to start until there was good control of non-native vegetation. Due to contracting and time

limitations, plantings had to occur at the same time that weed control was conducted. The time line for all activities to be finished on this project is the end of September, 2016. This project will eventually bring the Grand Valley unit to 100 percent of the concurrent acreage replacement goal, and involves the improvement of wildlife habitat on five properties managed by Colorado Parks and Wildlife (CPW) adjacent to the Colorado River near Grand Junction. Removal of tamarisk, Russian olive, and noxious weeds will allow herbaceous ground cover to be re-established at the properties. The project also includes planting cottonwood trees and willows.

The Grand Valley Wildlife Replacement Project came in under budget, and there are new potential wildlife habitat replacement projects that western slope NRCS employees have recently scoped out. Some funding from the left-over Grand Valley wildlife replacement project funds could be reobligated to complete these new projects. Some workgroup members have discussed priorities for these left-over funds, and the logistics and time frame for fund expenditure on the new projects. After discussions with NRCS and CPW, the Service salinity coordinator believes that it would be beneficial to be able to use some of these left-over funds for another year of weed control on the Grand Valley wildlife replacement sites, due to removal of large acreages of tamarisk and Russian olive and the inherent weed problems associated with this treatment. Funding could be used for another potential wildlife replacement project here in the Grand Valley (C½ Road) that is adjacent to those already, for a total of an additional 11 acres, at an estimated cost of $19,000. Workgroup discussions from the Cheyenne meeting found general agreement that weed control funding could continue if needed in 2017, and that the C ½ Road Wildlife Replacement Project could also use reobligated leftover funds.

Wildlife Replacement on BLM Land

Colleen Green (BLM) led a webex in March with the topic of exploring opportunities to conduct wildlife replacement projects on BLM lands. Webex participants included BLM State Leads, NRCS, Reclamation, and the Service.

BLM has already been involved with projects that restore native habitat along portions of the Colorado River system. Reclamation and NRCS seek input from local BLM managers in Colorado and Utah to determine if opportunities exist for Reclamation and NRCS to provide financial and technical assistance to the BLM to create, restore or enhance wildlife habitat on public lands in the Colorado River Basin. Where the enhanced or created values meet the "replacement" criteria of Reclamation and NRCS, these agencies would claim the values to offset impacts or losses created by salinity control projects funded or to be funded by Reclamation and NRCS.

Reclamation, NRCS, and the Service have agreed that habitat replacement should occur as close to the area of lost habitat as possible. However, it is acknowledged that other characteristics of the habitat, i.e. long term management, adjacency, and connectivity, may be as or more valuable than replacement "in-kind and in-place". Therefore, the above entities have agreed that habitat replacement in the same sub-river drainage, i.e. Duchesne River, Price River, Gunnison River, McElmo Creek, of the Colorado River system is acceptable.

The group envisions that the following steps are needed to identify potential properties and to

enter into interagency agreements:

1. A proposal would be submitted from the interested BLM office with a statement of work (SOW). The SOW would identify the location of the property, the number of acres, and describe the general plan for restoration.
2. Reclamation's and/or NRCS and BLM biologists would visit the selected property and do an assessment of the property to get a baseline habitat value.
3. Project evaluation would include a restoration plan to identify the potential habitat values that can be created.
4. The Service Salinity Coordinator would be asked to review the property and the assessments and provide a recommendation.
5. An interagency agreement would be prepared and executed with the BLM that would include a SOW, deliverables, and amount of funding to be transferred.

A 1-page pre-proposal process would include the following information:

a. Project Title:
b. Project location and its relation to nearest salinity control unit:
c. List the partners involved and their contribution, e.g. financial assistance (salaries, in-kind, etc.), technical or mechanical contribution.
d. Project implementation and completion dates?
e. How will operations and maintenance of the lands be met for the MOU agreement time period in addition to monitoring responsibility and habitat and/or wildlife values are maintained (as should be stated as part of agreement)?
f. What is the amount of funding (non-BLM) requested to establish habitat values?
g. *How will habitat values be created (need to address enhancing existing habitat, restoring degraded habitat, and creating new habitat)?
h. *Have baseline habitat values been established?
i. *How many habitat values will be added?
j. Project Objective(s).
k. Provide budget and deliverables.
l. Provide Background Information.

Additional Information:
*NRCS and Reclamation use different methods to assess habitat values. This needs to be decided beforehand and stated in the MOU/agreements as necessary for clarity for BLM Wildlife Replacement in Wyoming

<u>Other Wildlife Replacement Activities</u>

Final Monitoring of SCU's Before Close-out

<u>Big Sandy SCU</u>

A meeting was held in Rock Springs, WY this April, 2016 to discuss the dry up of the Coy-Eden wetland, which is a large, open-water (approx. 40 acres) wetland just east of the Farson, WY

Feed Store located in the Big Sandy SCU. The wetland was dry during 2014 and 2015, but once again held water in 2016. The temporary dry up of this wetland helped to identify a need to determine if wildlife replacement is still proportional and concurrent for the Big Sandy SCU—especially before this unit is officially closed out. The group discussed what methods would be appropriate to evaluate habitat replacement sites, and to assess any loss of habitat. Some degree of ground-truthing is needed in the evaluation. Travis James proposed randomly selecting 5 sites in each of three size classes: e.g. (1) Less than 0.5 acres, (2) greater than 0.5 acres but less than 2 acres, (3) greater than 2 acres. These sites could be visited, and the results would be used to extrapolate to the entire population of sites. The meeting participants included: NRCS employees from Salt Lake City, Utah, and Wyoming offices in Casper, Rock Springs, Lyman, and Riverton; Reclamation employees from Utah in Salt Lake City and Provo; and Service employees from Grand Junction, CO and Lander, Wyoming. NRCS in Wyoming, with assistance from Reclamation and the Service, agreed to conduct surveys of the existing wetlands in the Big Sandy SCU area to determine if wildlife replacement is still proportional and concurrent. These surveys are planned for the near future.

Instream Wildlife Replacement Projects

Henry's Fork SCU

Due to small acreages and shortage of water in this SCU, it was discussed in the EIS that it would be difficult to replace all wetland habitats that are lost during salt control projects. After multiple conference calls with NRCS, Reclamation, and Service employees, it was determined that instream improvement projects would help to meet replacement values, and allow wildlife replacement to be proportional and concurrent to losses. The Montana Wetland Assessment Method (MWAM) is used by NRCS to assess and score impacts associated with salinity control projects in the Henry's Fork SCU.

This is the first time that instream projects have been credited for wildlife replacement of loss associated with salinity control projects. The table below displays some wildlife replacement projects that are planned or have been completed in the Henry's Fork SCU. Of interest are the instream projects like the Peoples Canal Fish Barrier. This structure is protecting populations of Colorado River cutthroat trout and native bluehead and flannelmouth suckers by preventing recently introduced burbot and other non-native fish species in Flaming Gorge Reservoir from moving into the system.

Figure 2 - Peoples Canal Fish Barrier – before and after project

The Blue-bell diversion improvement is another example of an instream improvement habitat replacement project in the Henrys' Fork SCU. The current diversion is a push-up dam, and when river flows are low, the Blue Bell dam becomes a seasonal fish barrier. Improving the diversion will allow native fish to access habitat needed during different life stages, and will promote connectivity between populations, that in turn improves genetic integrity and increases probability of persistence. This project is expected to seasonally reconnect an estimated 35 river miles.

A new habitat replacement calculator was developed in 2014 regarding instream projects providing wildlife replacement credits in the Henry's Fork SCU. The scoring for instream projects can be calculated easily with the replacement calculator based on how many estimated stream miles the new fish-friendly diversions will allow passage for. The project categories in the calculator include: wetland restoration, wetland enhancement, wetland creation, riparian grazing, instream habitat, perpetual easement - wetland, perpetual easement - upland, refuge expansion, upland habitat improvement, instream flow, fish barrier construction, fish screen construction, and fish friendly diversion. Project ranking criteria include the following categories: location of practice, similarity to lost values, presence of species of concern, a misc. multiplier, project size, MWAM points, professional ranking, a MWAM multiplier, replacement points, pts/unit, a MWAM multiplier, and total replacement points. For location of practice, scoring is as follows: within Henry's Fork Salinity Project Area = 5, within Green River Watershed below Fontanelle = 3; within the Green River watershed above Fontanelle = 1. For similarity to lost values, scoring is 4 points for in-kind and 1 point for out -of- kind. For species of concern within the proposed habitat replacement project, scoring is as follows: contains threatened and endangered species = 5, contains State Species of concern = 3, contains game species = 2, and contains other species = 1. The miscellaneous multiplier involves three different kinds of project categories, including: (1) habitat quality for easements, refuge expansion, and upland improvement projects, (2) fish barriers or fish friendly diversions, and (3) fish screens. Scoring for habitat quality for easements, refuge expansion, and upland improvement projects is as follows: Unique, diverse = 1, Important = 0.7, and Common = 0.5. Scoring for fish barriers or fish friendly diversions are: Full = 1, Partial = 0.7. And scoring for fish screens includes: (1) many fish are lost in the ditch = 1, (2) moderate fish loss = 0.7, low fish loss = 0.3. Project size is determined in acres or 1000's of feet of stream impacted upstream of barrier, screen, diversion or 10's of AC/FT of water. An example of the calculators' use on a habitat replacement project is displayed in Figure 1.

Figure 3 - Instream Habitat Replacement Calculator

	Location of Practice	Similarity to lost values	Species of Concern	Misc. Multiplier	Project Size	MWAM Points	Professional Ranking	MWAM Multiplier	Replacement Pts	pts/unit
Wetland restoration	5					35	1.375		48.125	2.4 pts/ac
Wetland enhancement	5					35	1.25		43.75	2.2 pts/ac
Wetland creation	5					60	1		60	3 pts/ac
Riparian grazing	5					61	0.875	0.75	40.03125	2 pts/ac
Instream habitat	5					140	0.625		87.5	5.25 pts/ac
perpetual easement- wetland	5	4	3	1	20		1	0.1	24	2.4 pts/ac
perpetual easement- upland	5	1	5	0.7	500		0.125	0.1	48.125	0.10 pts/ac
Refuge Expansion	1	1	5	1	320		0.625	0.1	140	0.4 pts/ac
Upland Habitat Improvement	5	1	5	0.5	100		0.25	0.1	13.75	0.14 pts/ac
Instream Flow	5	1	3		23.8		0.875	0.1	18.7425	per year?
Fish Barrier Construction	5	1	3	1	184.8		0.375	0.1	62.37	1.8 pts/mi
Fish Screen Construction	5	1	3	1	316.8		0.5	0.1	142.56	2.4 pts/mi
Fish Friendly Diversion	5	1	3	1	316.8		0.75	0.1	213.84	3.6 pts/mi
Ranking Criteria	Henry's Fork Salinity Project Area = 5; 3= Green River Watershed below Fontanelle; Green River above Fontanelle = 1	In-kind = 4 Out-of-Kind = 1	T&E = 5 State Species = 3 Game = 2 Other = 1	Habitat Quality for Easements, Refuge Exp., Upland Improvement Unique, diverse =1 Important = 0.7 Common = 0.5	Acres **or** 1000's of ft of stream impacted upstream of barrier, screen, diversion **or** 10's of AC/FT of water					

Wildlife Replacement Site Visits

Grand Valley SCU

Site visits were conducted to: (1) assess if wildlife credits were being maintained, and (2) to investigate possibilities for future wildlife replacement opportunities. Identified needs to maintain wildlife habitat credits for these properties included: (1) control of tamarisk and Russian olive regrowth in areas where they had previously been controlled, (2) control of Russian knapweed and white top/Hoary cress, (3) beaver control where damming of high Se water is occurring. After talking with the area managers for these parcels, it was determined that further work would increase habitat value on these parcels.

One identified need expressed by area managers is tree thinning at Grand Junction Wildlife Area (WA) and Debeque WA. Because cottonwood trees on some of these parcels had a survival rate that was much higher than anticipated (after 17 years of growth), thinning is needed to improve the cottonwood stands. The planted trees are evenly spaced, and have the look of a tree plantation. There is very little understory shrubs or grasses as the trees shade everything out. Some trees have multiple trunks. The tree canopies have no room to grow out and expand, as they are so densely planted. These trees lack strong lateral branches. If thinned, lateral branch development would provide habitat for birds such as turkeys roost. A wildlife replacement project will occur this fall, which would allow gradual thinning of trees on the Grand Junction WA to provide increased habitat value. This project would serve as replacement habitat for losses associated with GVIC Phase III & Phase II segment relocation. The Service salinity coordinator participated with Reclamation staff in a field day at Grand Junction WA, where volunteers helped to remove weed barriers from cottonwood trees that were planted as part of a restoration project nearly two decades ago. The weed barrier fabric did not break down as expected and is currently keeping the trees from growing properly into mature cottonwoods. Participants used scissors and/or box cutters to remove the weed barrier. Another "free the tree" field day is planned for this fall.

Lower Gunnison SCU

A site visit was made to Escalante State Wildlife Area (SWA) (connected to the lower Gunnison SCU). The purpose of this visit was to meet with the new CPWA manager and representatives from Uncompahgre Valley Water Users to evaluate rehabilitation of the Roubideau Creek ponds, to be used as a wildlife replacement project for habitat loss associated with the remainder of Phase 7 and 8 of the Eastside laterals salinity control project. The Service salinity coordinator provided suggestions for this project. The wildlife replacement project plan is currently under development.

Site visits were conducted for July 6 and 7 to assess several other basin-wide funded wildlife replacement projects in various stages of implementation in the lower Gunnison SCU. On July 6, site visits included the replacement projects on Escalante State Wildlife Area, including the Roubideau Ponds for Phase VII/VIII and the 52 acre tamarisk and Armory Pond for Phase II. On July 7, site visits were conducted on several landowner properties associated with the following salinity control projects: (1) Roger's Mesa, (2) C-Ditch, (3) Grandview, and

(4) Cattleman's. These wildlife replacement projects involve: (1) non-native vegetation removal, (2) plantings of native vegetation, (3) pond construction, (4) pond bank stabilization, and (5) wetland enhancement.

Price-San Rafael SCU

David Snyder (Reclamation-Provo Utah) shared movies and pictures of the Cottonwood Creek Restoration and Mitigation Project area. PacifiCorp owns the property, and the Mill Ditch habitat replacement will occur on this site. A couple months ago, rotenone was released into the pond on this property, to eliminate non-native fish predator species. Native roundtail chub were then released into the pond, which will serve as a roundtail chub propagation area, and is the first in the State of Utah.

<u>Review of Monitoring and Evaluation (M&E) Reports----NRCS Wildlife habitat projects</u>

In February 2016, the Service coordinator provided comments back to Ed Neilson in the Grand Junction NRCS office after reviewing draft M&E reports written by Frank Riggle about salinity control units in Colorado. These comments were in turn forwarded to the NRCS State Office.

After review of the NRCS 2015 M&E reports for Wyoming, Colorado, and Utah, the Service coordinator has assessed the progress of NRCS in replacing fish and wildlife habitat forgone as a result of implementing salt control measures. Table 2 displays an updated summary to evaluate and compare salinity control units (SCU's) and determine whether wildlife habitat replacement is concurrent and proportional with the acres of salt control projects completed to date.

Wyoming

In 2005, the Big Sandy SCU in Wyoming was determined to be concurrent with wildlife habitat replacement acres, with the replacement goal exceeded by about 10.8 acres. Loss of water in a 40-60 acre wetland near Eden, Wyoming was called to our attention in 2014, and this pond remained dry until 2016, when it once again contained water. Loss of this wetland was not identified as a potential in the EIS. This incident identified a need to assure that acres of habitat replacement are still functioning as intended, and that replacement credits are still proportional and concurrent before any SCU is officially closed out. Before the Big Sandy SCU is officially closed out, a determination is needed to assess wildlife replacement sites. NRCS in Wyoming, along with partners, will conduct a project-wide assessment this fall or next spring to determine if other habitat has been lost or gained in order to determine if wildlife replacement is "concurrent and proportional for the Big Sandy SCU."

For the Henrys' Fork SCU, the Peoples Canal Fish Barrier is the one habitat replacement project that has been completed. There are three more projects that are planned for the future, listed in Table 1. The total habitat values lost thus far are 28.3, and the total habitat values replaced are 178. Thus, the Henry's Fork SCU is proportional and concurrent with wildlife habitat replacement.

Table 2 - Habitat replacement values for the Henrys' Fork salinity control unit

Name	Habitat Value	Replacement Value
Peoples Canal Fish Barrier	100 stream miles protected	178.2
Beaver Creek Riparian Fencing	18.48 acres excluded from grazing	60 estimated
Blue Bell Diversion Improvement with	35 stream miles seasonally connected	87.3 estimated
Beaver Creek Diversion	6 stream miles seasonally connected	14.9 estimated

Colorado

For the state of Colorado, ongoing field inventory demonstrated that Mancos Valley wildlife habitat replacement is proportional and concurrent and has still exceeded wildlife habitat replacement goals at 187 percent goaled acres. Ongoing field inventory confirmed that 103 acres are still maintained. Over the past seven years from 2009 through 2015, wildlife habitat replacement totals in the lower Gunnison have increased from 60 percent to 104 percent of the concurrent goaled acres. Additional emphasis placed on increasing the number and size of wildlife habitat projects has been highly successful, and with continued outreach this trend is expected to continue.

Salinity control units that are not concurrent and proportional with wildlife habitat replacement acres in Colorado include: McElmo Creek, Grand Valley, and Silt. Wildlife replacement acreage in the McElmo Creek project area is at 280 acres or 88 percent proportional and concurrent. Results from a few years ago indicated that previously reported habitat improvements may have been lost due to development and other land-use changes. There was a drop from an estimated 451 acres down to 204 acres after ½ of the replacement sites had been surveyed. It was reported that the on-going habitat assessment may not be able to track all habitat projects previously reported due to changes in staff and missing inventory data. It was noted that several upland acres were also acquired in the McElmo Project area, but it was unknown whether the upland habitat could meet suitable replacement requirements, and thus was not included in the initial totals.

The Grand Valley wildlife habitat goal is 1,206 acres including DeBeque and Whitewater irrigation improvements. With the ongoing Grand Valley wildlife replacement project, the Grand Valley is expected to meet and exceed replacement acreage goals by approximately 100 acres and become proportional and concurrent. An issue previously identified with the Silt SCU is that there are only a few landowners that are interested in habitat improvement projects. Currently, this is still the case. An issue identified with the lower Gunnison SCU is that only small parcels are currently available for habitat projects. These small projects are complex in planning and habitat enhancement options, and they provide relatively small acreages per project. NRCS has made additional efforts in the Gunnison SCU with wildlife habitat only sign-ups to engage various conservation groups and other Federal and State agencies to accelerate the implementation of wildlife habitat enhancement projects. Success from these approaches is reflected in the increased acres that have been acquired in the lower Gunnison SCU during 2015, including 143.6 upland acres and 18.4 wetland acres. The wildlife habitat replacement totals

from 2009 -2014 have greatly increased and replacement is currently proportional and concurrent. In addition, there were 113.5 acres of replacement wildlife habitat planned that will result in additional habitat acres over the next few years. A goal of NRCS is to encourage habitat replacement projects with better connectivity and a longer-term life expectancy.

Utah

For the state of Utah, NRCS associated with the Price-San Rafael and Uinta SCU's have exceeded the recently adopted replacement goal of 2 acres of wildlife replacement habitat per 100 acres of salt control projects, at 5 percent and 13.3 percent respectively. For the Price-San Rafael area, NRCS changed its methodology to include more precise measurements of actual habitat extents by incorporating detailed mapping, establishment of permanent photo points, and smaller-scale case studies to refine information from Landsat images. Because this approach is more labor intensive, a need for additional staff still exists, to make sure wildlife replacement is concurrent and proportional.

Those SCU's in Utah not concurrent with wildlife habitat replacement include: Manila-Washam SCU, Green River SCU, and Muddy Creek SCU. The Muddy Creek and Green River SUC's have barely gotten off the ground yet and have little on-farm treatment, and thus no wildlife habitat replacement. The Service continues to encourage NRCS to work with the U.S. Forest Service (USFS) to obtain secure water rights for wildlife habitat on the Henry's Fork wetland complex located on Forest Service property near Manila, Utah. These wetlands represent an important aspect of wildlife habitat in the Manila-Washam SCU. There is concern that piping of the Peoples Canal and subsequent irrigation changes from flood to sprinkler may impact USFS wetlands, as well as wetlands downstream.

With a salinity coordinator now on board for the Uinta Basin, the Service hopes that potential partnerships on wildlife replacement projects with the Ute tribes can be explored. The Service will continue to work with NRCS to identify and solve issues connected with wildlife replacement projects, and to help identify potential replacement opportunities. Of concern is that there have been several "salinity wildlife only" project applications received, but none have advanced toward funding. In this fourth year of eligibility for Utah basin-wide salinity projects, there have been no awarded contracts for wildlife only habitat projects.

It should be noted here that inventories completed on habitat replacement sites may result in a reduction of acres considered habitat replacement. Major reasons for this issue provided in some of the M&E reports include urban development, changes in land management, and changes in land ownership. For wildlife replacement to be concurrent and proportional with salinity control project implementation, and to replace additional habitat replacement acres lost during the life of the salinity control projects, NRCS will need to continue to emphasize habitat replacement as a high priority for the agency. Most of the wildlife habitat replacement projects require time to become fully functional and reach their full habitat potential. For example, it takes a long time for planted cottonwood trees to develop into a mature gallery. Continued follow-up by NRCS is critical to support landowners with project implementation, and to assure that reported program habitat replacement goals are maintained. Any acres lost during the life of the salinity control program will need to be replaced to maintain a concurrent status.

Training

The Service salinity coordinator attended a riparian restoration workshop in February sponsored by the tamarisk coalition. This workshop focused on non-native vegetation removal, wildlife response, and monitoring success on projects in the western U.S. She also attended a June workshop focused on assessing riparian proper functioning condition (PFC). PFC is a qualitative assessment that evaluates how well physical processes in a riparian-wetland area are functioning. In August, the Service salinity coordinator attended a meeting to develop a system to identify, frame, and prioritize projects in terms of existing grant programs for migratory bird habitat restoration. These training opportunities are helpful in the assessment of wildlife habitat impacts from salinity control projects, and the evaluation of wildlife habitat replacement projects.

Table 3 - Summary of wildlife habitat replacement in salinity control units for 2015

Salinity Control Units	Habitat Acres Acquired in 2015	Habitat Acres Cumulative Total	% Goaled Acres	Total Needed Acres	Remaining Acres Needed to be Concurrent	Comments
Colorado						
Lower Gunnison Unit	18.4 acres wetland, 143.6 acres upland 113.5 planned	1,400	104%	1,340 Current Total =115,000 x 0.02=2300	0 for concurrent 900 for total	67,016 salt control acres thus far 115,000 acres full salt control project implementation The shift to wildlife only contracts allow field biologists to focus on high priority projects and provide flexibility to work with non-traditional producers, and to partner with other agencies.
Grand Valley	3.3 acres	778	64%	1206 including Debeque & Whitewater	428	Separate negotiated replacement of 1,206 acres 60,000 acres full salt control project implementation, adjusted full potential=42,800 acres, with 42,860 to date or 100% project goal. Contract under way for Grand Valley Wildlife Replacement Project-Implementation will exceed goal by approx.. 100 acres if fully implemented.
Mancos Valley	None	103	187% concurrent 95% total	55 concurrent 1 total	0 for concurrent 1 for total	To date 2748 acres salt control 5400 acres full salt control project implementation Ongoing field inventory has confirmed 103 acres are still maintained, or 187% Recent inventory complete-Reassessed in 3 years
McElmo Creek	12 acquired 0.5 acres planned	280	88%	318	38 for concurrent 151 for total	To date, 15,879 acres salt control projects 21,550 acres full salt control project implementation
Silt	None	19.4	64% (19.4/30.6) concurrent 39% total	40 riparian/upland 10 wetland	9.2 for concurrent 30.6 for total	To date 1712 acres salt control, 2800 acres full salt control project implementation The 2 acre per 100 acre rate does not apply to the Silt Unit due to a BE that predicted loss of 50 acres of wetland, riparian, and upland habitat losses. The Silt Unit concurrent value is based on the acres treated divided by the planned treatment acres, times the 50 acres of proposed wildlife habitat replacement, (1,712 ac/2,800 ac) x 50 ac =30.6 acres to be concurrent. Estimated habitat loss is 15.7 acres.

Table 3. cont'd. Summary of wildlife habitat replacement in salinity control units for 2015.

Salinity Control Units	Habitat Acres Acquired in 2015	Habitat Acres Cumulative Total	% Goaled Acres	Total Needed Acres	Remaining Acres Needed to be Concurrent	Comments
Utah						
Green River	None	None	0%	41.6 with full implementation	10.3	Through 2015 – 513 acres treated. 2080 acres full salt control project implementation Local landowners balancing need to buy energy for pumping for sprinkler systems. No economical gravity pressure.
Manila-Washam	2.2	8	5% concurrent	EIS goal 156	8/156=5%	7780 acres full salt control project implementation. To date, 4003 acres salt control
Price-San Rafael	None planned. 13.1 in active contracts	3,735 total	11.1% >100% of 2% goal	None	None	Problem with enough staff to do M&E of habitat replacement projects 36,050 acres full salt control project implementation To date 33,526 acres salt control
Uinta	None	21,000	(13.5% of treated acres) >100% goal of 2%	None	None	225,000 full salt control implementation To date 158,092 acres salt control
Muddy Creek	1	None	1%	121	120 with full project implementation	Project hasn't taken off the ground yet. Lack of hydrological infra-structure is impeding the creation of on-farm grant opportunities, 192 acres treated 6050 acres full salt control project implementation

Table 3. cont'd. Summary of wildlife habitat replacement in salinity control units for 2015.

WYOMING						
Salinity Control Units	Habitat Acres Acquired in 2015	Habitat Acres Cumulative Total	% Goaled Acres	Total Needed Acres	Remaining Acres Needed to be Concurrent	Comments
Big Sandy	None	860	100+ ??	???	???	As of 2013, Habitat replacement goal exceeded by 10 acres. To date, 13,077 acres treated for salt control. It has recently been discovered that more wetland habitat may be needed to meet replacement goal.
	Habitat Replacement Values Acquired in 2015	Habitat Replacement Values planned for 2016	Habitat Replacement Values planned for 2017	Total Needed Habitat Values	% of Goaled Habitat Values	Comments
Henry's Fork	178.2 Planned 60+18.48+87.3+14.9=180.4	178.2	178.2/28.3=> 600%	0	0	Loss of wetland habitat values associated with irrigation improvement projects is estimated using Montana DOT wetland assessment tool. Wetland habitat values replaced is also estimated using this Montana DOT wetland tool. A new model developed by NRCS and USFWS is being used to assess In -stream wetland habitat replacement values.

U.S. Geological Survey (USGS)
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2016

The USGS conducts a variety of science activities to assess salinity conditions in the Colorado River, guide program management decisions, and to determine the effect of salinity control efforts. These activities are conducted in cooperation with the Forum and in support of Federal resource management agencies including BLM, Reclamation, and NRCS. In addition, activities and accomplishments in USGS National programs such as the National Streamflow Information Program (NSIP) and the National Water-Quality Assessment (NAWQA) Program provide valuable information to Salinity Control Program (SCP) agencies. These SCP science-support activities and relevant USGS National program activities (described below) range from data collection in a basin-wide monitoring network, to research on the fate and transport of salt at various scales.

Colorado River Basin Monitoring Network and Basic-Data Collection: Enhancements to the USGS National Real-Time Water-Quality Web Interface for the Colorado River Basin 20-Station Monitoring Network

Figure 4 - USGS gage–Green River near Greendale, UT

The USGS currently operates a network of 20 streamflow gaging stations for Reclamation for purposes of tracking and modeling current and future estimates of salinity concentrations and loads in the Colorado River Basin (CRB) (figs. 1 and 2). Streamflow and specific-conductance data from this network are used by the USGS to model salinity concentrations and loads (SLOAD output) for use by Reclamation in the Colorado River Simulation System (CRSS) water-supply and salinity projection models. Reclamation depends on the CRSS for midterm and long-term supply and water-quality studies in the CRB. During midterm studies, water-quality results are substantially impacted by initial model conditions, which include salinity concentrations downstream of major reservoirs such as Lakes Powell and Mead.

During FY 2010 (October 2009 – September 2010), the USGS evaluated new methods to model and deliver monitoring data and estimated loads from the 20-station monitoring network such that the information is delivered to Reclamation using a more timely approach. The USGS found that a method for providing instantaneous or “real-time” salinity concentration and load at USGS gaging stations is currently available from the Kansas Water Science Center (KWSC). Real-time salinity concentrations and loads for the 20-station network sites are currently being served to the public on the National Real-Time Water Quality (NRTWQ) website at *http://nrtwq.usgs.gov/*;

however, Reclamation would like to modify the output format of the website to match their specific CRSS formatting requirements.

The project has three objectives:

1. Provide real-time total dissolved- solids concentrations (TDS) at both a daily and monthly time step for the 20-station monitoring network.
2. Improve web interface for data retrieval. All sites would be accessible from one location rather than by multiple states in the CRB.
3. Develop a procedure that can read in data from the 20 station sites to the Excel file "PR Monthly Data Record 20xx.xlsx" that USGS provides to Reclamation biennially.

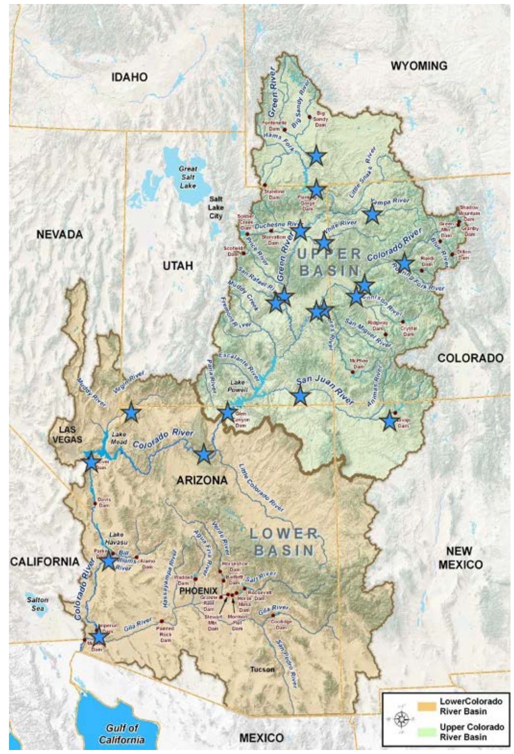


Figure 5 - Location of monitoring sites in the 20-station network

The KWSC has completed all project objectives and is beta testing them in cooperation with the Colorado Water Science Center (CWSC). Graphics and information enhancements are included at no cost to this project as part of a KWSC refresh to the website. Kansas expects to have a test release available for cooperator (CRSS modelers from Reclamation) viewing in late October. The CWSC acts as liaison to KWSC and Reclamation and will be the main contact for Reclamation comments and requests. A full version of the new features on the NRTWQ website is expected to be available in mid-December.

Documenting the Effects of Grazing on Sediment, Water, and Salinity Production from Mancos Shale Soils – Badger Wash, Colorado

The Badger Wash study area provides a unique opportunity to assess impacts of domestic grazing on runoff and erosion of the Mancos Shale. The study area has eight paired watersheds (ranging in size from 12 to 107 acres), with one of each pair fenced in 1953 to exclude domestic livestock and the other watershed open to grazing. The area has been grazed by domestic livestock since the late 1800s, primarily by cattle, but early settlers grazed sheep extensively. In arid and semi-arid ecosystems, overgrazing often results in decreased vegetative cover, increased soil compaction, and breaking up of stabilizing soil crusts, leading to increased runoff and erosion. Such changes to hydrology and erosion are of particular concern for soils derived from saline parent material (such as Mancos Shale) due to potential negative impacts on instream water quality. Since 2006, the USGS has used the grazing treatments and subsequent variability in soil and vegetation attributes to address basic questions related to soil and hydrologic processes on the Mancos Shale. In the Badger Wash study area, the USGS Southwest Biological Science Center is monitoring hillslope scale erosion using silt fences, dust erosion using passive dust traps, and instream flow and water quality using instrumented weirs.
The goal of this study is to: (1) determine if differences in sediment production between grazed

and ungrazed pastures persist, (2) assess if the contrasting land-use histories affect instream water quality (salinity), and (3) evaluate if current models can capture variability in runoff and erosion that exist in the study area.

Activities in FY 2016 were focused on hillslope sediment monitoring and modeling. Hillslope erosion has been measured since 2008 using 20 silt fences initially installed in watersheds 3A (grazed) and 3B (ungrazed) on various substrates. In November 2012 an additional 63 fences were installed bringing the total to 83 silt fences. These new fences allowed us to look at erosion in the mixed, shale, and alluvium parent materials in all watersheds. Sediment from all 83 silt fences was collected annually in the fall.

In the fall of 2015, a subset of silt fences was selected for measurement of ground and foliar cover, soil stability, and soil roughness (see next paragraph). Plant and ground cover data were collected at 16 silt fence hillslopes using line point intercept (LPI), soil aggregate stability, and canopy and basal gap (following Herrick and others, 2005). Additionally, given the high surface roughness of some Mancos Shale soils as well as additional roughness provided by strong biological soil crust development, a surface roughness index was measured at 15 to 20 locations per hillslope using the jewelry chain method (Saleh, 1993). LPI data were used to parameterize the Rangeland Hydrology and Erosion Model (RHEM; Nearing and others, 2011) and model runs were conducted using the web interface at *http://apps.tucson.ars.ag.gov/rhem/tool#*, accessed July 29, 2016.

Analysis of the silt fence collection data from 2013 and 2014 shows that sediment production (in kg m^{-2}) is strongly correlated with slope ($r = 0.63$), solar insolation ($r = -0.59$), and area ($r = -0.67$). Comparison of model fit supports the area covariate model as the best (includes sample year, soil type, grazing history, and all interactions). Model fit statistics (AIC) are improved with the addition of slope without interactions). Based on this model, we found a significant effect ($p < 0.05$) of grazing, year, and soil type on sediment with grazed > ungrazed, shale > mixed, and 2014 > 2013. There was an interaction between years and soil type with mixed increasing 14 times and shale only 3 times between years. Grazing treatments were similar in 2013 but substantially greater differences were noted in 2014. Precipitation was greater as was the number of very intense storms in 2014, likely causing the difference in years.

There is significant variability in sediment production not explained by the final statistical model. To further understand controls over hillslope erosion processes, the RHEM model was parameterized with field soil and vegetation cover data and compared with long-term average yield (kg m^{-2}). RHEM-estimated sediment production had a strong correlation with measured sediment ($R^2 = 0.62$); however, silt fence measured sediment was only about one-quarter of that modeled by RHEM (slope estimated at 0.235). These results suggest that RHEM may over predict sediment production on Mancos Shale soils (long-term average precipitation from Fruita, CO and used in RHEM is 218 mm; precipitation in 2014 was 345 mm).

We also evaluated if adding hillslope data on soil stability and roughness, with slope interactions, would improve the predictions. Based on the lowest AIC score, the best model included predicted RHEM sediment plus soil stability; roughness and slope; as well as interactions of soil stability times roughness and slope times roughness. This expanded model increased the R2

value to 0.87. However, parameter estimates portray a complex interaction among soil aggregate stability, roughness, and slope, with measured erosion going up by singular effects of slope, soil stability, and roughness, but also being reduced by the interaction of roughness and soil stability, and slope and roughness. We expected soil stability and roughness to be negatively correlated with sediment production (and explain over predictions by RHEM). However, regression results suggest that only when both soil stability and roughness are high is sediment production reduced. More work is needed to understand these complex interactions.

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Hydrogeologic Characterization of Paradox Valley and Evaluation of Alternatives for Salinity Reduction in the Paradox Valley Unit, Montrose County, Colorado

Figure 6 - Paradox Valley

Paradox Valley in western Colorado is a collapsed salt anticline (fig. 3), where groundwater flow has led to the dissolution of salt deposits and the development of a highly concentrated groundwater plume of brine in the central part of the valley. The Dolores River, a tributary to the Colorado River, flows across the axis of Paradox Valley and functions as a groundwater discharge location. Here, the Dolores River experiences substantial increases in salinity as it intercepts the brine, with historical (1988-1995) salt loads estimated to range from about 95,000 to 205,000 tons per year. Under the Colorado River Basin Salinity Control Act, Reclamation constructed and operates a salinity control project, the Paradox Valley Unit (PVU), to reduce salinity loads to the Dolores River. The project consists of a series of shallow pumping wells designed to intercept the brine before it flows into the river and an injection well that disposes of the produced water in deeper geologic formations. The injection well system is nearing the end of its useful life, and Reclamation is exploring alternative strategies to reduce the salinity loads to the Dolores River. Possible future mitigation alternatives to be assessed include: (1) reducing recharge on the valley floor through modification of surface-water impoundments and (or) watercourses, and changing irrigation practices, and (2) managing (increasing) the stage of the Dolores River in the

valley to decrease the groundwater gradient and flow between the aquifer and the river. The USGS is assisting Reclamation in these efforts through the development of conceptual and numerical groundwater flow and transport models and supporting hydrogeologic characterization.

Hydrogeologic Characterization -- Airborne Geophysical Data Processing and Interpretation for Paradox Valley

One major component of the hydrogeologic characterization is the processing and interpretation of previously collected airborne geophysical data. The USGS had airborne electromagnetic (AEM) surveys over the Paradox Valley flown in October 2011. The AEM method characterizes the electrical resistivity of subsurface materials to depths up to 250 meters. Variations in electrical resistivity are highly sensitive to variations in the concentration of total dissolved solids in groundwater, small percentages of which can dramatically decrease bulk resistivity. Resistivity is also sensitive to the presence of clay or other conductive minerals and to variations in water content and grain-size distribution. The sensitivities of the AEM method to changes in total dissolved solids and lithologic composition make resistivity-based interpretations ideal for defining the shallow geometry of the brine plume.

The objectives of the AEM study are to: (1) evaluate the contractor-delivered data (completed in FY2014), (2) develop and execute appropriate AEM data processing and inverse modeling schematics, and (3) develop interpretations of the brine plume geometry and surrounding subsurface geology. A USGS Open-File Report publicly releasing the contractor-provided data was completed in March 2015 (Ball and others, 2015). In addition to stochastic inverse models developed in 2014, the USGS developed new inversion models in FY2015 using a least-squares approach to develop best-fit resistivity models of the Paradox Valley AEM study area. These models, in conjunction with the stochastic models, were used to refine and complete the interpretation of the freshwater-brine interface. A report, in the format of an open-access peer-reviewed journal article, has been prepared documenting the freshwater-brine interface interpretation and discussing the hydrogeologic implications (Ball and others, in prep.). This article will be provided to Reclamation when the review and approval process are completed and will include the final interpretive results of this study. The two publications from the study are:

Ball, L.B., Bedrosian, P.A., and Minsley, B.J., in prep., Resolving the freshwater-brine interface below the Paradox Valley collapsed salt anticline with airborne electromagnetics: Open-access journal article.

Ball, L.B., Bloss, B.R., Bedrosian, P.A., Grauch, V.J.S., and Smith, B.D., 2015, Airborne electromagnetic and magnetic survey data of the Paradox and San Luis Valleys, Colorado: U.S. Geological Survey Open-File Report 2015–1024, 19 p., *http://dx.doi.org/10.3133/ofr20151024*

Groundwater-Flow Modeling and Evaluation of Water-Management Scenarios for Salinity Reduction

The USGS has developed conceptual and numerical models of the Paradox Valley groundwater-

flow system to aid in understanding brine movement in the valley and for evaluating the effects of potential water-management scenarios on brine discharge to the Dolores River. A conceptual model of groundwater hydrology and water quality in the Paradox Valley was developed that provides an improved understanding of the hydrogeologic framework, the spatial and temporal distributions of recharge, groundwater-flow directions, salt dissolution, and stream-aquifer interactions. A numerical groundwater-flow and transport model was developed beginning in 2011, which quantifies the water and chemical budgets for the Paradox Valley including the PVU. The numerical model provides a tool for quantitatively assessing groundwater flow and brine movement toward the Dolores River and for evaluating the effect of potential water-management scenarios on brine discharge. In 2015, the numerical model was updated to include results for the freshwater-brine interface from the AEM survey, and simulations of water-management scenarios were initiated.

To increase the amount of quantitative data to support modeling, the USGS conducted a 3 -month aquifer test in the spring of 2013 utilizing existing PVU brine-production wells and nearby monitoring wells. Monitoring wells were instrumented with sensor-transducers to monitor changes in water levels and temperature. Small-diameter tubes were attached to transducers to permit collection of water samples at various depths within the monitored wells. Samples were collected before, during, and after the test to evaluate vertical distribution of fluid density and specific conductance within the wells. Pressure transducers were installed at existing conductance monitoring sites in the Dolores River to monitor stream stage and water temperature. Analytical and numerical models were used to analyze the aquifer-test data to determine hydraulic properties of the aquifer and effects of the position of the freshwater-brine interface on brine discharge to the river. Results from this aquifer test have been incorporated into the numerical model.

Calibration of the three-dimensional numerical model indicated that temporal variations in brine discharge to the Dolores River primarily are related to variations in infiltration of water (irrigation return flow and conveyance losses) in the western part of the valley, and to seasonal variations in stage of the Dolores River. These results suggest that water-management operations that increase freshwater heads in the alluvial aquifer could suppress the freshwater-brine interface and reduce brine discharge to the river. The processes and parameters that control these responses, however, are complex. The USGS is currently using the model to evaluate the effects of managing (increasing) the stage of the Dolores River in the valley to decrease the groundwater gradient, flow between the aquifer and the river, and thus brine discharge. Scenarios that increase or decrease recharge on the valley floor through manipulation of irrigation practices or modifications of surface-water impoundments also were explored. A report presenting the conceptual and numerical models underwent revisions in 2016 and publication is expected by the end of calendar year 2016.

<u>Estimates of Salinity Loads for the Dolores River in Paradox Valley, Western Colorado</u>

Reclamation evaluates the efficiency of the PVU based on differences between the TDS loads computed at two USGS gaging stations on the Dolores River. Dolores River at Bedrock (USGS station 09169500) is located where the river enters the valley (upstream from the PVU), and the Dolores River near Bedrock (USGS station 09171100) is located where the river exits the valley

(downstream from the PVU) (fig. 4). Loads are based on continuous measurements (15-minute interval) of specific conductance and discharge at the two gages and monthly water-quality samples, which are used to develop regressions between TDS and specific conductance. The USGS periodically assists Reclamation with updating the regressions and salt load estimates as new data become available.

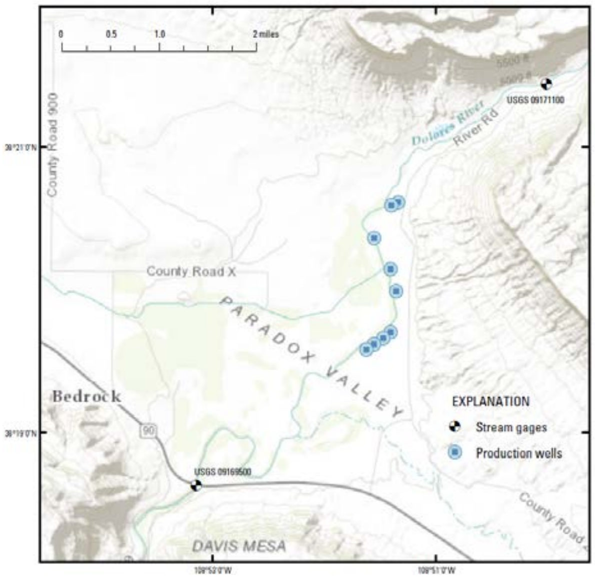

Figure 7 - Map of the Dolores River in Paradox Valley showing locations of streamgages and production wells

In 2016, the USGS began a new project to develop new regression models that relate TDS concentrations to specific conductance for the period of record from 1980 to 2015 for the two Dolores River sites that bracket the PVU in the Paradox Valley. The two most recent USGS publications are a study by Chafin (2003), which developed regression models and computed daily loads for January 1988 through September 2001, and a more recent study by Linard and Schaffrath (2014), which developed regression models for water years 2009 through 2012. These results will be used to update the regressions equations reported on the USGS NRTWQ website (*http://nrtwq.usgs.gov/*), which were originally published by Linard and Schaffrath (2014). The updated regressions are complete, the results are being applied to continuous records of specific conductance and discharge to estimate the gain in salt load to the river as it flows across the Paradox Valley for water years 1980 through 2015. The results are also being used to evaluate the efficiency of the PVU. A report documenting the regression analysis and loading calculations is currently (September 2016) in draft form and will be published in 2017.

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Statistical Modeling (SPARROW and LowGunS) Applied to Assessing the Distribution of Salinity Loads and Load Sources in Streams of the Upper Colorado River Basin

The USGS has developed two models to assess the distribution of salinity loads in surface waters and sources of those loads in the Upper Colorado River Basin (UCRB): (1) The UCRB SPARROW (Spatially Referenced Regressions on Watershed) attributes model and (2) the Lower Gunnison River Basin Water-Quality model (LowGunS). These models represent the surface-water flow system at basin and sub-basin scales and are based on conceptual models that relate observed loads in UCRB streams to up-basin physical characteristics including elevation, precipitation, geology, land cover, and land and water use. Both models estimate salinity load and load sources and can be used to improve SCP managers' and planners' understanding of the salinity-load balance and to prioritize and optimize SCP resources toward efficient and cost-effective control projects.

Model estimates are currently being used by SCP participating agencies to meet a variety of information needs. Work continues, however, to enhance the accuracy and utility of these models as part of SCP science planning.

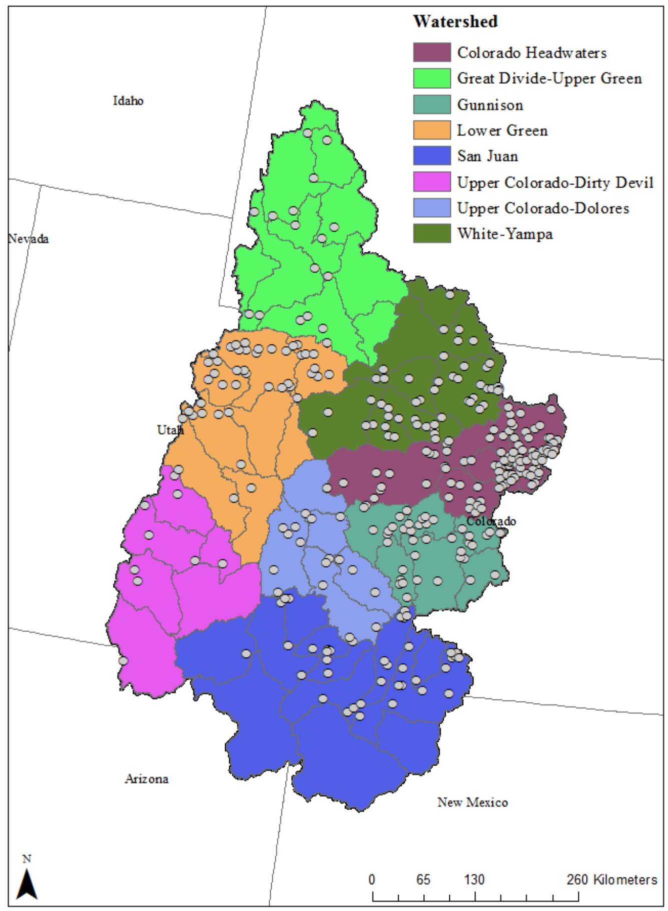


Figure 8 - Map of the Upper Colorado River Basin showing the location of major watersheds and 318 monitoring stations (grey points) where salinity loads were estimated and are being used as calibration data in SPARROW 2.0.

Upper Colorado River Basin Salinity Modeling – Updated and Enhanced SPARROW Model (SPARROW 2.0)

The UCRB SPARROW model (UCRB SPARROW 1.0) was developed by the USGS in 2009 to provide improved understanding of the spatial distribution of salinity sources, load accumulations, and transport mechanisms in the UCRB. This model relates observed salinity loads in UCRB streams to up-basin physical characteristics including elevation, precipitation, geology, land cover, and land and water use, and routes those loads through the stream network to estimate loads in more than 10,000 unmonitored stream reaches. A report describing this work and an interactive map product are available at *http://pubs.usgs.gov/sir/2009/5007/.* Model-estimated loads and load sources (e.g. natural vs. agricultural sources) allow managers to better understand and estimate load distribution and yield to streams in any area of interest, even if little or no data are available for that area. In turn, this information can be used to prioritize and optimize SCP

resources toward efficient and cost-effective control projects. Model estimates are currently being used by SCP participating agencies to meet a variety of information needs. Work continues, however, to enhance the accuracy and utility of these models as part of SCP science planning.

Although the UCRB SPARROW 1.0 model continues to be used in a variety of roles as a management tool, the model has several significant limitations that can now be addressed to a degree by applying recently gathered data and evolving GIS methods. One of these limitations is the fact that the model represents conditions in water year 1991 - a time when salinity loads were below average throughout most of the basin. Further, the model does not differentiate among irrigation methods (e.g. flood vs. sprinkler irrigation), which can greatly affect the amount of unused irrigation water available to transport salts to streams. SCP managers are interested in revising the model to represent nearer-to-average flow and loading conditions, and to incorporate current land-use and water-use data, including the effects of various irrigation practices on dissolved-solids loading.

In 2013, the USGS completed two activities to support the future update and enhancement of the UCRB SPARROW model: (1) development of a new water-quality data set from a subset of active USGS gages in the UCRB (available at *http://pubs.usgs.gov/of/2014/1148/*), and (2) development of a geospatial model describing irrigation status, including irrigation method, in the UCRB). The updated water-quality data set includes long-term mean annual estimates of salinity loading at 318 sites for use as model calibration data (fig. 5), compared with 181 sites used in the SPARROW 1.0 model. The data set also includes data from 76 gaging stations in the UCRB that were collected between 2009 and 2013 for the express purpose of augmenting water-quality data for use in developing an improved understanding of salinity loads and sources. The new geospatial data set contains a spatially consistent and accurate definition of where irrigation is occurring in the UCRB and the method of irrigation (flood vs. sprinkler irrigation).

In 2014 and 2015, the USGS began development of an updated UCRB model referred to as SPARROW 2.0. The updated model builds on the geospatial basin characteristic data sets and modeling approaches developed for the SPARROW 1.0 model with emphasis on providing estimates of salinity load in the UCRB that reflect the current level of salinity control on irrigated lands under long-term streamflow conditions. Work to date has included construction of the UCRB stream network, calibration to the aforementioned long-term mean annual salinity loads at 318 sites, and compilation of recent (2010) watershed characteristics data sets, including the updated irrigation dataset. The updated model is complete, and the report documenting the model and simulations is in USGS review and will be published in 2017. After the model report is published the model will be made publically available and can be used via a web interface on the USGS SPARROW Decision Support System (*http://cida.usgs.gov/sparrow/#*)

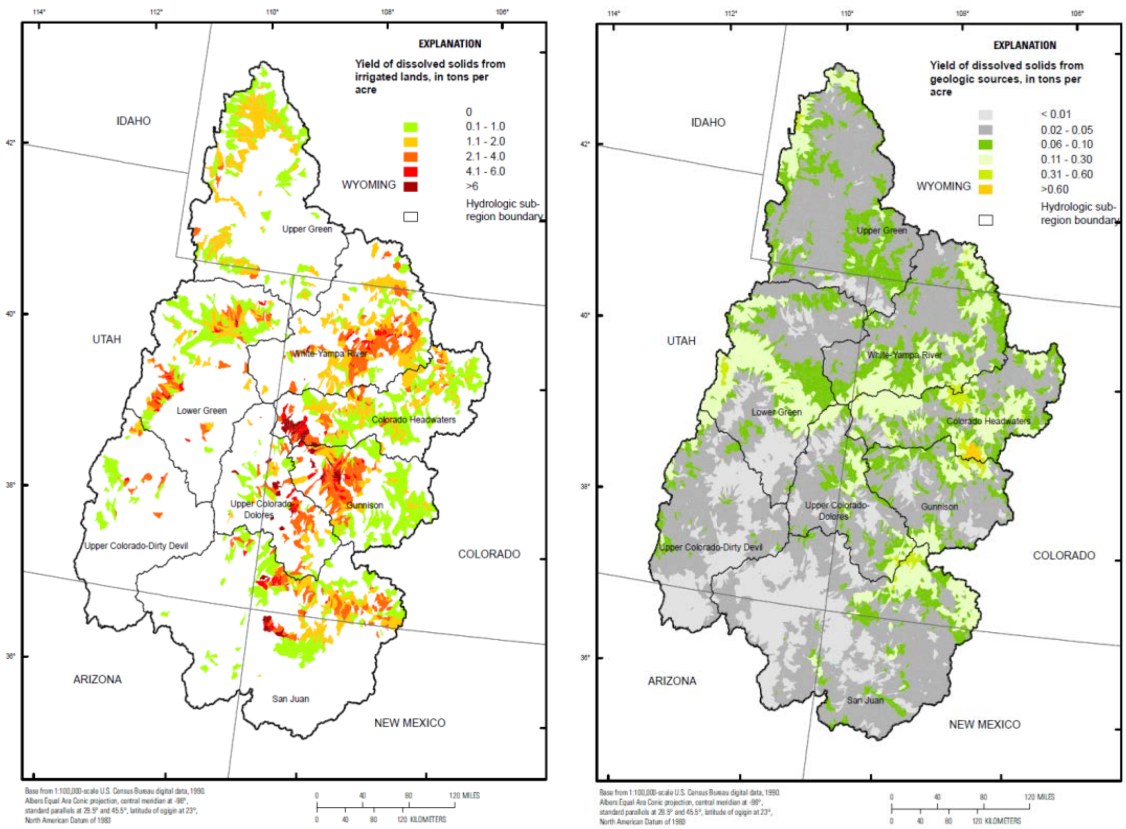


Figure 9 - Dissolved-solids yields from irrigated lands and from geologic sources, Upper Colorado River Basin

The USGS continues to work closely with Reclamation scientists and engineers to maximize the SPARROW model utility toward the enhancement of future Reclamation salinity transport models, including providing estimates and predictions of agricultural and natural salinity loading to the CRSS model.

Ranking Sub-Basin Salinity Loads in the Lower Gunnison River Basin

The USGS, in collaboration with Reclamation, is using the LowGunS model to define a ranking of sub-basins (by tons of salinity load) in the Lower Gunnison River Basin, which will allow for objective, informed targeting of sub-basins for salinity control projects and will provide information to estimate the cost per ton of salinity removed from the system by off-farm salinity control projects.

The results of the ranking exercise will be used to locate high priority areas (cost effective areas for salinity control as determined by Reclamation). This ranking process is especially useful for data-poor areas that otherwise would have limited justifications for priority salinity control efforts. Collection of salinity and streamflow data will be done in areas that were data poor and ranked as high priority for salinity control projects. A report documenting the LowGunS model updates has been completed and was published October 2013. A USGS report documenting the ranking study can be found at *http://pubs.er.usgs.gov/publication/sir20135075*.

The SCP partially funded ($30,000) additional LowGunS modeling for estimating salinity loading in the Lower Gunnison River Basin as a means to improve existing Hydrologic Identifier (HIDs) ranks. These funds, in conjunction with funds from the State of Colorado, will be used to improve the geospatial representations of physical features used to model salinity loads. New layers such as perched ponds and septic system location and size will also be explored. In addition to improving the geospatial component of the model, the USGS will develop the LowGunS model such that the existing loading cap for salinity is met and a temporal component is included. These modifications exist to meet a new requirement by Reclamation to provide more consistent salinity loading estimates now and in the future for use in the Reclamation Funding Opportunity Announcements (FOAs). The temporal component is intended to make the LowGunS model better represent salinity loads prior to the onset of salinity control efforts, yet be flexible enough to represent more current conditions when geospatial layers are updated. If the LowGunS model tracks accurately through time, there may be a potential to run simulations of the effects of future land use and salinity control efforts.

In January 2015, an updated LowGunS salinity model was delivered to Reclamation for use in estimating salinity loads from off-farm sources as part of the current FOA. The results of the modeling effort will be published in late 2016 or early 2017 along with results from Se modeling that is underway in the Lower Gunnison Basin.

Investigation of Transport of Dissolved Solids Discharged from Pah Tempe Springs, Southern Utah, and Possible Remediation of Salinity Load to the Virgin River

Pah Tempe Springs (also known as Dixie Hot Springs) (fig. 7) discharge substantial amounts of dissolved solids (salt) to the Virgin River, which are then transported downstream and contribute to the salinity of the Colorado River. Consequently, these salts affect the suitability of water in the Lower Colorado River Basin for agricultural, industrial, and domestic uses. Studies conducted in the 1970s and 80s determined that desalinization of the water discharged from Pah Tempe Springs is technically feasible. However, the reduction in dissolved solids that would have been realized in the Colorado River from this type of project was less economical, at the time, than other proposed projects and involved more uncertainties. Consequently, the project was not implemented

Figure 10 - Pah Tempe Springs, Washington County, Utah

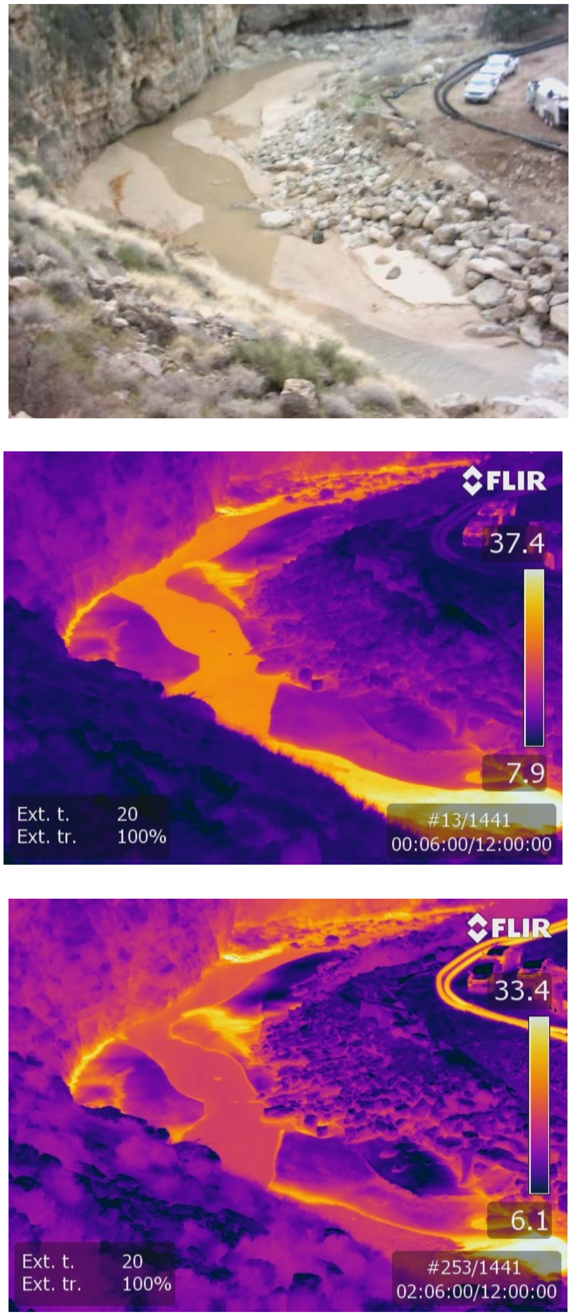


Figure 11 - Use of thermal imagery to assess changes in temperature (as a surrogate to salinity load) in the Virgin River during Pah Tempe Springs pump tests: (Top) Photo of part of the study reach impacted directly by Pah Tempe Springs discharge, (Middle) Pre-test thermal image of same reach (displayed temperature range is in degrees C), (Bottom) Thermal image after pumping has started (pipeline transporting pumped thermal water can be seen in the upper right of the photo and high temperature area at bottom right of photo is shrinking).

During 2007-08, the USGS in collaboration with the SCP conducted a preliminary assessment of the transport of dissolved solids from Pah Tempe Springs downstream to below Littlefield, Arizona. This first-phase study was conducted to provide managers with information needed to determine if they should proceed with a more rigorous and comprehensive assessment of the Pah Tempe Springs salinity load and the development and consideration of possible remediation scenarios. Results of the Phase I investigation, which comprised longer data record periods than the previous studies, indicated that flow and salinity loads in the Virgin River Basin were substantially different during 1992-2006 than those reported for the period prior to 1971. The Phase I investigation also concluded that removal of salts discharged from Pah Tempe Springs could result in a larger reduction in dissolved-solids loads in the river at Littlefield, Arizona, than was previously estimated by Reclamation.

On the basis of these results, SCP managers determined to move forward with a comprehensive investigation (Phase II). The scope of work for this second phase was defined by recommendations resulting from Phase I and included an additional assessment of salinity load lost as seepage from the Virgin River and whether that load was returned to the river via Littlefield Springs.

The results of Phase II have been documented in the USGS Scientific Investigations Report "Hydrosalinity studies of the Virgin River, Dixie Hot Springs, and Littlefield Springs, Utah, Arizona, and Nevada", which was published in 2014 and is available at *http://pubs.usgs.gov/sir/2014/5093/*. Key findings generally confirmed the results from Phase I and indicate that a significant portion of the discharge from Littlefield Springs comes from Virgin River seepage to groundwater and has an apparent travel time from losing reaches of the river to the springs of less than 30 years. The preliminary results imply that a hypothetical reduction in dissolved-solids load in the Virgin River below Littlefield Springs, if Pah Tempe Springs salts were restricted, may be from about 67,500 or 71,500 tons/year immediately and as high as 90,000 tons/year within 30 years of restriction.

The USGS, in cooperation with SCP, Reclamation, and the Washington County Water Conservancy District (WCWCD), is completing two study tasks as part of a third study phase (Phase III), exploring the feasibility of Pah Tempe Springs load mitigation scenarios and the effects of mitigation on downstream Virgin River flow, chemistry, and ecology.

One potential approach to reducing the Pah Tempe Springs salinity load to the Virgin River would include pumping thermal water from within the Hurricane Fault damage zone to lower the groundwater pressure head at spring discharge locations and reduce or eliminate discharge from the springs to the river. The Colorado River Basin Salinity Control Forum, Reclamation, and local water managers would like to know if this approach is a feasible solution, what level of groundwater withdrawal might be needed to capture a large percentage of saline spring discharge to the river, and what would be the effects of the tested range of withdrawal rates on the quality of the extracted water and on streamflow conditions below the springs in general.

A B

Figure 12 - (A) Sump structure used for pumping thermal water from the Hurricane Fault damage zone during Pah Tempe Springs interference tests. Concrete vaults on the left bank of the Virgin River were placed on top of rip rap in the excavated sump with discharge lines from multiple submersible pumps tying into two main discharge lines (figure to the right), and (B) pipelines used to transport thermal groundwater pumped during Pah Tempe Springs interference tests to a point below the study reach where it was discharged back into the Virgin River.

To meet these information needs, the USGS designed experiments to assess the effects of groundwater withdrawals from the Hurricane Fault zone on discharge of saline water from Pah Tempe Springs, and on the flow and quality of water in the receiving Virgin River (figs. 8 and 9). Tests were conducted in November 2013, February 2014, and November 2014 when thermal groundwater was pumped from the fault zone.

Test results showed that pumping to capture thermal saline water is nearly 100 percent efficient with low flow in the Virgin River upstream of the study reach, and that unwanted freshwater capture can occur when the background river stage is higher. Drawdown and spring discharge reduction observed during pumping showed that the near-surface bedrock aquifer is extremely permeable. Groundwater temperature data indicate that the source of thermal water occurs several hundred feet upstream of the Hurricane Fault. The study report for Phase III is complete and is beginning USGS technical review.

A groundwater flow model of the fault damage zone has been constructed for use in assessing test results and for evaluating future diversion and treatment scenarios. The subsurface characteristics of the Hurricane Fault zone are unknown and is a limitation of the model. To

learn more about geothermal flow in the fault zone, a fourth phase (Phase IV) was added to the investigation. This phase, which will be conducted in cooperation with the WCWCD in FY2017/2018, will involve drilling three test wells into and adjacent to the fault zone to investigate the hydraulic properties and geochemistry and fluid flow. These data will then be incorporated into the model. Test well drilling is being funded by the WCWCD and is projected to begin in the fall of 2016.

Study results aid in understanding the general hydraulic characteristics and properties of the fault zone and will allow for assessment of the feasibility and effectiveness of a range of possible pumping scenarios to reduce salinity load to the river. In particular, the groundwater flow model will aid in optimization of well placement and pumping schedules should a salt load mitigation project be developed. This will allow Reclamation and SCP managers to assess the scope and cost of Pah Tempe Springs salt load mitigation approaches that incorporate groundwater pump-and-treat techniques.

Rangeland Sources of Salinity – Evaluation of the Effects of Selected Rangeland Conditions on the Sources and Transport of Dissolved Solids Delivered to Streams in the Upper Colorado River Basin

The USGS, U.S. Department of Agriculture (USDA) Agricultural Research Service (ARS), Reclamation, and other member agencies of the Colorado Salinity Control Forum have been working together to further the understanding of dissolved-solids sources and transport processes in the UCRB since the 1970s. While many past studies have focused on irrigated agricultural lands, the overall objective of this study is to improve the understanding of sources and transport mechanisms in rangeland catchments that deliver dissolved solids to streams in the UCRB. An important goal is to gain knowledge about how certain land management practices or land conditions may be affecting dissolved-solids yields to streams, such that changes in these practices and conditions could be made to reduce dissolved-solids yields.

The study consists of six phases, including: (1) a literature review on sources and transport of dissolved solids in rangelands (completed), (2) a synthesis of the literature review (completed), (3) a GIS reconnaissance of the effects of rangeland conditions on dissolved-solids yields (completed), (4) an evaluation of the potential to improve an existing dissolved-solids source and transport model for the UCRB by better accounting for relevant factors in rangelands, including development of a SPARROW II and watershed scale model simulation of salinity loading, and (5) an analysis of the relation between dissolved solids and suspended sediment in streams in the UCRB. Phase 6 is the reporting phase and will document the knowledge gained in phases 1-5, which will be reported in individual reports associated with the phases.

Relations between the health of rangelands (i.e. state within an Ecological Site) and transport potential of salts identified in this study may reveal where conservation practices can be applied to cost-effectively reduce dissolved-solids yields to UCRB streams. In addition, several of the datasets compiled in this study will be evaluated for incorporating into USGS SPARROW model updates, potentially reducing the uncertainty of these models and providing enhanced capability of running prediction scenarios that evaluate the effects of different land conditions and water-management practices on dissolved solids in UCRB streams.

Study phases 1 and 2 have been completed by the USDA ARS. The bibliography on salinity mobilization and transport has been completed. A summary report “Salinity mobilization and transport from rangelands: Assessment, recommendations, and knowledge gaps” has also been completed and is available at *http://www.coloradoriversalinity.org/docs/Salinity%20Mobilization%20and%20Transport%20from%20Rangelands.pdf*.

The remaining study phases are ongoing with tasks now shifting to the USGS. Phase 3, compiling geospatial datasets for investigating the effects of rangeland conditions on UCRB dissolved-solids yields for the next SPARROW model is complete and the report, “Geospatial datasets for assessing the effects of rangeland conditions on dissolved-solids yields in the Upper Colorado River Basin”, is available at *http://dx.doi.org/10.3133/ofr20151007*. Estimates of long-term salinity loading in UCRB rivers and streams at qualifying monitoring sites have been completed. The new estimated distribution of salinity loads will be compared to geospatial models of rangeland conditions and management practices and will be incorporated into the updated SPARROW model in study phase 4. These updated long-term load estimates and the methods used to obtain them are documented in the USGS report “Updated estimates of long-term average dissolved-solids loading in streams and rivers of the Upper Colorado River Basin”, available at *http://pubs.usgs.gov/of/2014/1148/*.

Many management practices to reduce dissolved-solids loading are based on the assumption that reducing suspended sediment reaching surface waters will reduce dissolved-solids loads to those waters. There have been no published studies, however, to determine if there is a relation between suspended-sediment and dissolved-solids concentrations in rivers. For phase 5 of the study, the USGS conducted such an investigation on the effect of suspended-sediment concentrations on dissolved-solids concentrations in UCRB streams and rivers. Multiple linear regressions were used on streamflow and water-quality data from 164 sites in the UCRB to develop dissolved-solids models that include combinations of explanatory variables of suspended sediment, flow, and time. Results from statistical tests on the models indicate that 68 of the UCRB sites have strong or moderate evidence of a relation between suspended-sediment and dissolved-solids concentrations, with drainage areas for many of these sites composed of a large percentage of clastic sedimentary rocks. Preliminary results of the work have identified 10 sites that have strong evidence of an effect of suspended sediment on dissolved solids and had high dissolved-solids yields in the drainage areas. These results could assist water managers in the region in directing field-scale evaluations of suspended-sediment control measures to reduce UCRB dissolved-solids loading. Methods, data, and results are discussed in a journal article “A data reconnaissance on the effect of suspended-sediment concentrations on dissolved-solids concentrations in rivers and tributaries in the Upper Colorado River Basin”, published in 2014.

As part of the investigation of salinity sources from natural landscapes, the USGS is testing a model for simulating salinity mobilization and transport at a watershed scale using the same models that the USDA ARS and BLM are going to be using across the UCRB. The second study is examining how stream chemistry can be used to assess the source of salinity from a natural landscape.

Modeling Rangeland Dissolved-Solids Sources in Muddy Creek and Molen Seep Wash, Utah

The SCP has been working to further understand dissolved-solids sources and the associated transport processes in rangelands in the UCRB. Rangeland management has operated under the presumption that changes in land cover result in changes in watershed conditions and load response. However, these correlations are masked by transient fluctuations in precipitation, surface runoff, or irrigation practices. The overall objective of this study is to develop a conceptual model to assess scaling-up hydrologic parameters estimated from rainfall plot-scale experiments to the watershed scale. In addition, the conceptual model will be used to assess how different scenarios of land use and climate might affect dissolved-solids loads.

The plot-scale rainfall-runoff experiments were completed by the USDA ARS at the Molen Seep (Dry X) study area. An APEX model incorporating salinity is being developed for parts of the Muddy Creek and Molen Seep (HUC12) watersheds. Land use, soil distribution, and topographic characteristics are used to construct the model domain. In addition, long-term meteorological parameters (air temperature, precipitation, wind, solar radiation, and relative humidity) from 11 stations in and around the watersheds are used (fig. 10). Four USGS streamflow gages in the watersheds were used for salinity load calculations. At the Upper Muddy Creek, the Lower Muddy Creek, the Molen Seep Wash, and the Molen Seep tributary streamgages, continuous stage, discharge, and specific conductance were monitored with periodic analyses of event water quality.

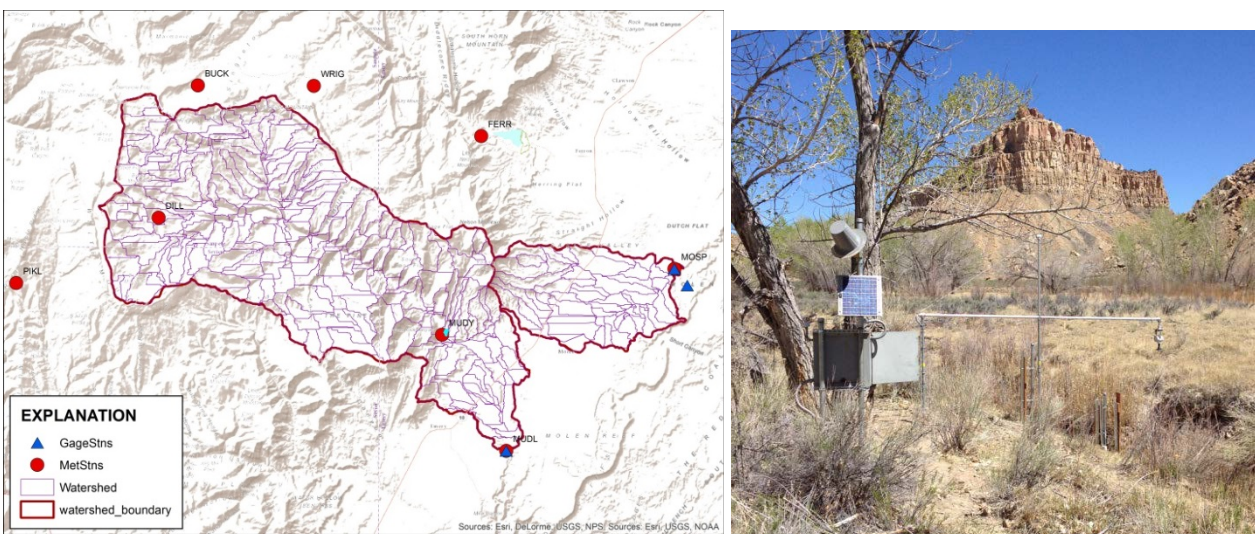


Figure 13 - Study watersheds showing the modeled sub-catchments, meteorological stations, and streamgages. The photograph is of USGS streamgage 385202111121601, Muddy Creek below Miller Canyon near Emery, UT.

As of 2015, the watershed model has been constructed and the weather, land use, and soil databases have been populated. The model will be used to simulate the distributed discharge and dissolved-solids loads at locations throughout the model domain as well as the four stream gages. Simulated model loads will be compared to observed discharge and dissolved-solids loads for overall consistency. Finally, the model will undergo a limited calibration to optimize the simulated response to the observed data sources.

The model will be used to conceptually investigate various scenarios of land use and vegetation changes on dissolved-solids loading in the watersheds. The precipitation volume, event length, and temporal distribution of events also will be varied to better understand the effects on dissolved-solids loading to the streams. The model has been completed and scenario analysis is being conducted. Much of the model report is also written and anticipated publication will be in late FY2017. The model scenarios can be used to assess where conservation practices can potentially be applied to cost-effectively reduce dissolved-solids yields to UCRB streams.

Use of Stream Chemistry as an Integrator of Watershed and Landscape Processes to Assess Salinity Sources and Loads and their Relation to Natural Landscapes

The SCP is conducting studies to develop modeling tools to estimate salinity loading and to assess approaches to synthesizing and scaling-up rain-simulation plot-scale experiment results to develop conceptual and numerical sub-watershed scale models of salinity transport in selected areas in the UCRB. Additionally, there is a need for data from streams to connect source material to the stream salinity loading that is actually occurring. A more detailed understanding of the geochemical fingerprints of waters received by streams draining natural landscapes allows us to trace those waters to their sources and to constrain and refine future conceptual or simulation assessment models, as well as assess the accuracy and utility of their projections of the effects of management practices at various scales. Streams integrate the effects of all the hydrologic flow paths, processes, and surface activities in a watershed. As a result, stream chemistry will also reflect this integrated signal and has been used to forensically investigate sources, transport, and the fate of chemical constituents including salinity. This study is using integrated stream chemistry to assess sources of salinity from natural landscapes and provide the data required to assess transport mechanisms in future modeling and land-management decision support tools.

Synoptic sample sets have been collected in 2016 on Muddy Creek and the San Rafael River in central Utah (figs. 11 and 12) from the headwaters to their confluence with the Dirty Devil and Green Rivers under low flow conditions. These sample sets represent the sources and chemistry of baseflow loads. Additional samples will be collected during runoff events that represent the surface component of loading. Results from the baseflow sample sets indicate that there are distinct chemical signatures to the salinity loading from the Mancos Shale and the Carmel Formation, a Jurassic-age interbedded gypsiferous sandstone/limestone/siltstone.

Figure 14 - Water sample collection along the San Rafael River

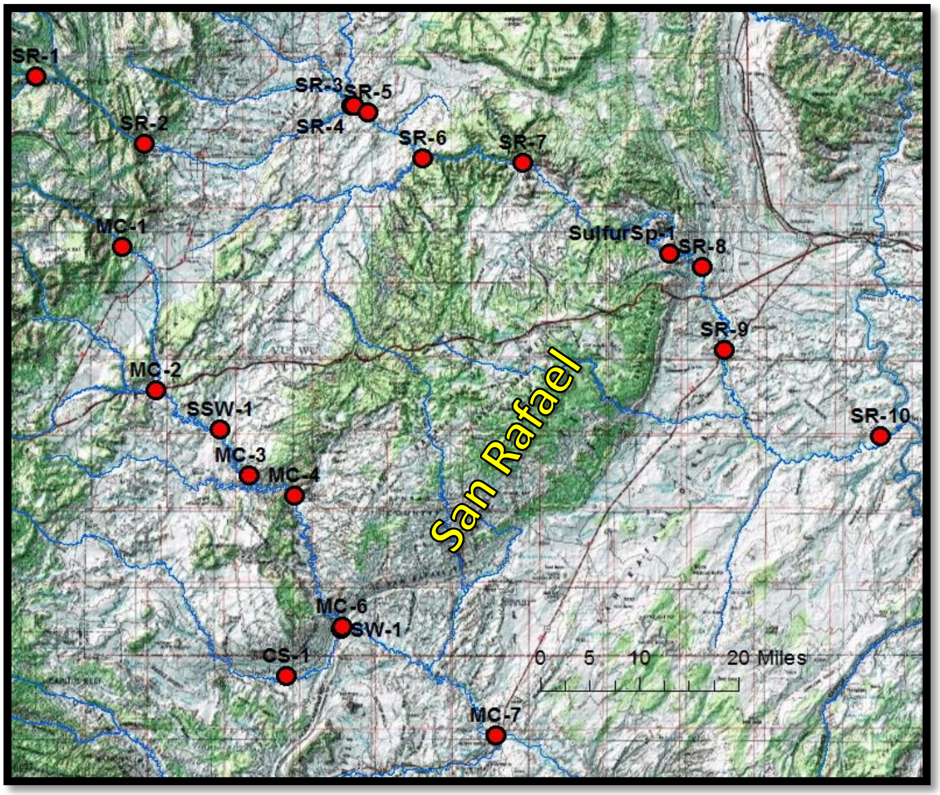


Figure 15 - Synoptic sampling sites on Muddy Creek and the San Rafael River.

Trends in Surface-Water Salinity and the Effects of Salinity Control Projects in the Uinta Basin, Utah

In 2014, the USGS began a study to assess salinity trends in Uinta Basin streams and to quantify the effects of salinity control projects on salt loads to Uinta Basin surface waters. Specific study objectives include:

1. Assessing trends in salinity load at selected sites in the basin that drain both natural and agriculturally-affected landscapes,
2. Apportioning changes in salinity load into agricultural sources and non-agricultural sources (natural sources), and
3. Comparing agricultural amounts determined from trend analysis to on-farm and off-farm SCP salinity reduction estimates from Reclamation and the NRCS.

Salinity loads and trends during water years 1989–2013 were estimated for 15 surface-water sites in the Duchesne River Basin and parts of the middle Green River Basin in Utah. These sites provide salinity load and trend information for the Uinta Basin. Downward trends in salinity load were determined for sites downstream from irrigated agricultural areas, whereas no trend was evident for sites near headwaters, upstream of irrigated areas. The study report has been completed, gone through peer review, is in final layout and editing, and will be published in early FY2017.

Results of the study will enable SCP managers, Reclamation, and the NRCS to evaluate the effects of salinity control projects on salinity levels in the Duchesne River and other streams in the Uinta Basin, and improve understanding of the effects, if any, that changes in non-agricultural landscape and water use have had on the salinity levels in basin streams. This information can be used to evaluate best practices in salinity control in ongoing and future projects in the Uinta Basin.

Bureau of Land Management (BLM)
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2016

The BLM administers about 53 million acres of public lands in the Colorado River Basin (CRB) above Yuma, Arizona. Substantial portions of these public lands are ecologically classified as arid or semiarid rangelands. Point sources of salt on public lands include saline springs, seeps from marine sedimentary formations, abandoned flowing wells, discharge from abandoned mines, and discharge of waters from authorized activities such as oil and gas production or mining. Nonpoint sources of salt include surface runoff, soil erosion, stream sediments, and groundwater discharge to streams. Salts can be transported in solution or with solids such as soils or coarse fragments. Past studies have indicated that salt loading in rangelands is closely associated with sediment loading and that wind transport is the dominant mechanism of sediment movement across semi-arid and arid rangelands.

Salt concentrations on public lands tend to be highest in areas underlain by marine sedimentary rocks such as shales and mudstones that receive less than 8 inches of annual precipitation. Although salt concentrations can be very high in runoff from these lands, the frequency and volume of runoff is low because of the low precipitation and ephemeral nature of stream systems. Runoff from areas with highly saline soils in the upper basin is estimated to contribute about one-third of the annual salt load from BLM public lands.

The greatest volume of salt contributed from BLM-administered lands, however, is sourced from areas with moderate to low salt concentrations in soils that are relatively well-covered with perennial vegetation and receive more than 12 inches of annual precipitation. Although salt concentrations in runoff from these lands are low, total loading is relatively large because of higher water yields. These areas comprise about 67 percent of BLM-administered lands in the upper basin. Runoff from these areas is estimated to contribute more than half of the annual salt load from BLM-administered lands in the upper basin.

The BLM is committed to reducing salinity concentrations in the Colorado River sourced from its public lands as required by amendments to the Colorado River Basin Salinity Control Act of 1974 and mission mandates under the Federal Land Management Policy Act of 1976 (FLPMA). The BLM's primary strategy for reducing salt transport to the Colorado River is to minimize erosion from public lands through its existing land-management policies and practices. These policies and practices are intended to maintain or restore land-health as reflected by key ecological attributes such as soil and site stability, watershed function, and biotic integrity. The BLM manages public lands according to a multiple-use mandate under the FLPMA. Many land-use activities such as livestock grazing, energy development, mining, recreation, timber production, utility transmission, and road management increase erosion and sediment transport.

The BLM attempts to reduce these impacts to help maintain land-health standards by utilizing best-management practices; including terms, conditions, and stipulations in land-use authorizations; and requiring actions to restore lands upon completion of authorized activities. BLM also engages in many activities to restore degraded ecosystems that contribute excessive sediment and salts to CRB watersheds. These activities include constructing and maintaining

grade-control structures, spreader dikes, and retention structures; emergency stabilization and rehabilitation efforts following wildfires; removal of invasive plant species, channel stabilization, and other riparian enhancements; maintaining road culverts; remediation of abandoned mine lands, and fire fuels reduction treatments. Salinity reductions for many of these activities continue to be difficult to quantify and report to the Forum because of factors such as the lack of adequate understanding about mobilization and transport of salts from rangelands and inability to conduct effectiveness monitoring for all projects. Reports from BLM State Offices (see below) reference many of these activities and the BLM is engaged in efforts with partner agencies to improve future ability to quantify salinity reductions from these efforts. To address these challenges, the BLM is co-developing a system of tools/models: RHEM-APEX-AGWA ((Rangeland Hydrology and Erosion Model; Al-Hamdan et al., 2011); (Agricultural Policy EXtender model; Sharpley and Williams, 1990); (Automated Geospatial Watershed Assessment Tool; Hernandez et al, 2000)). The integration and linking of these tools/models was completed during FY2015. The collection of physical data to model parameter value justification is still being conducted on BLM CRB rangelands as previously funded by the Basin States Program and continued by the BLM.

Program Summary and Administration

The BLM established the Salinity Coordinator (SC) position in 2003. The BLM allocated $1,500,000 in FY2016 through the Soil/Water/Air (SWA) Program to fund the Salinity Program and support the salinity control objectives. Projects funded in FY2016 are described below in the State Reports section. In addition to the funding allocated from the Salinity Program, millions of dollars are expended annually by other BLM programs and authorized users of public lands on watershed management, restoration, and mitigation activities that retain sediment/salt and/or reduce/retain erosion/sediment and salt transport efforts. The salinity coordinator's position is funded separately from the salinity funding. BLM allocates the funding to its field offices. The budget allocation is predominantly distributed to implementation projects with some funding still given to planning projects according to need and availability of personnel to successfully accomplish projects.

Basin Wide Activities

Included in the funded projects is the BLM contracted work with USDA-ARS for multiple rainfall sediment and salinity transport projects. Data are being collected from Utah, Colorado, and other locations and will continue to be collected through 2018. This work continues from the previous BLM funded work (2012; Figure 1) to collect physical data to validate the tool(s) co-developed during FY2015. This tool can eventually be utilized for quantifying several BLM program's sediment and salinity contributions within the CRB and for prioritization of funding and future projects.

A novel approach to establishing a baseline from which to move forward was funded by BLM in December, 2012. Due to the lapsed labor funds from the vacant Salinity Coordinator position, BLM invested $100,000 in a joint USDA ARS-USDOI BLM project to conduct a study to improve the current understanding and identify the gaps in knowledge regarding the sources and transport mechanisms in rangeland catchments that deliver TDS to streams. A literature review ensued that is discussed in detail in the USDA-ARS section. The BLM, Reclamation, and NRCS

management practices were included in the search for their relationship to salinity reduction. Multiple products have resulted including a dynamic bibliography which continues to be active presently. New salinity literature is added as it is released in from many sources and citations can be viewed online.

Thus far, the findings have demonstrated that: (1) TDS is a good surrogate of salinity (Figure 1); (2) It is generally accepted that practices that reduce soil erosion and sediment transport might also reduce salt loading; (3) little literature exists on the relationship between rangeland management practices and runoff or sediment; (4) limited literature found on direct impact of land management practices (i.e., gully plugs, contour farming, chaining); (5) Currently relationship on salt- management practices inferred from assumed impact of practice on runoff and sediment loading (partly because of lack of supporting data) through changes in vegetation type and distribution, canopy and ground cover, and soil surface/hydraulic roughness; and, (6) Literature indicates that all practices that were evaluated for reducing salt loading have a defined lifespan and must be maintained (sediment removed from gully plug) or redone to be effective (contour furrow).

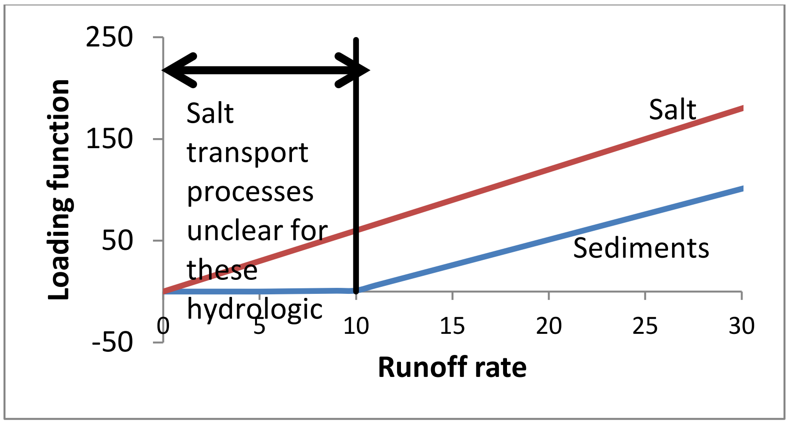


Figure 16 - Linear relation between runoff and salt/sediment.

It has been assumed there is a hypothetical linear relationship between runoff and salt /sediments. This relationship needs to be quantified for various dominant Ecological Sites due to inherent differences in salts in the soils across the basin and will change as a function of vegetation type, density, and canopy and ground cover (i.e. management).

The BLM continues to co-develop a plot to watershed tool, which includes water quality, to quantify management actions of sediment, and/or salt retained, by program management across the CRB. The expected completion period is approximately 2018 and BLM expects to be able to report on the quantification of effectiveness at this time. The collaboration with USDA-ARS has already resulted in multiple publications, books, and conference presentations.

Eventually the tool will lead us from BLM and BLM-collaboration funded plot or sub-catchment scale to watershed and, if needed, to regional scale. Our rainfall/salinity projects will be included in the tool and will be utilized for the combination of linked models as well. The sources and inputs of salinity data are now being received from more than just the Salinity subactivity. Other programs that indirectly or directly have been affecting salinity in the CRB

are: Recreation-OHV; Rangeland; Acid Mine Land; Riparian; Wild Horse and Burro Management; Fire and Revegetation Emergency Stabilization Recovery; Renewable Energy (rights-of-ways); Fluid Mineral (orphaned wells); Hazardous Fuels Reduction (Thinning Forests, Urban Interface); and, Forests and Wetlands (grazed, unmanaged lands, Christmas tree plots).

The BLM is not able to report reductions accomplished through many of these efforts to the Forum because of technical and programmatic issues, but is working to develop approaches needed to quantify reductions. Most programs should be integrated into the tool. This year's accomplishment report includes a limited number of programs.

Fuels Treatment Effectiveness Monitoring Program
Vegetation left on the ground inhibits the transport of sediment and salts. The BLM's Fuels Treatment Effectiveness Monitoring Program manages areas that are likely to intersect with wildfires leading to the destruction of vegetation and leaving paths for sediment and salinity surficial movement.

Within the Fuels Treatment Effectiveness Monitoring database (FTEM) and per IM-2015-001 which states that "offices will complete a fuels treatment effectiveness assessment and input appropriate information into FTEM for all wildfires which start in, burn into, or burn through any portion of a fuel treatment area that has been completed and reported in the Hazardous Fuels Module of the National Fire Plan Operations and Reporting System from FY 2003 to present." Utah has treatments after which they have 90 days to report it into the FTEM database. Since 2003, BLM has accomplished millions of acres of fuels management treatments including prescribed fire, seeding, thinning, mastication, and lop and scatter. Initially there is increased erosion; however, overall per acre burned there is 1 cubic yard of sediment retained. From 2010 through 2015, the Utah BLM Fuels Treatment Program has impacted sediment transport on 261,300 acres. The amount within the CRB is being quantified in addition to the amount burned. Wildfires have intersected many of these fuels treatments; in FY15 a minimum of 17,400 acres were burned in Utah that had been pre-treated by the Fuels Program. This results in approximately 17,400 cu yd of sediment retained on BLM land with the about half of it within the CRB Utah boundaries (8,700 cu yd of sediment retained = **2,349 tons retained**).

Emergency Stabilization and Rehabilitation Program
Emergency Stabilization and Rehabilitation is another BLM program that impacts sediment and salinity transport. Ten wildfires that have burned more than 10,000 acres, as addressed by the BLM, were identified for our modelling purposes. These fires included: the Rattle Fire Complex, the State Fire, the Lakeside Fire, the Dallas Canyon Fire, the Patch Springs Fire, the Faust Fire, the Grease Fire, the Clay Springs Fire, the Woods Hollow Fire, the Wolf Den Fire and the Baboon Fire. An example of what is being accomplished to gain the sediment retained on BLM land is the Rattle Fire Complex burned a total of 94,519 acres of which 50,000 acres was on BLM land. The ES&R report provides sufficient detail of the area and treatment as well as the related costs. That information is combined with existing vegetation, land use, soil, slope and climate data to compare pre-burn conditions to post-burn and post-rehabilitation conditions. Once approved by the BLM ES&R Program, the results will be added to sediment retained on BLM lands total.

Recreation-OHV (Off Highway Vehicle) Program
Within the entire CRB, we have calculated that the Recreation-OHV Program contains 89,700 miles of dirt roads that contribute to sediment transport (Figure 1.) Based on a pound of soil having an average of 3 percent salt and that an average of 2 cu yd are retained per mile of road maintained; it is assumed that at least one time since a BLM OHV road was maintained since it was built. This it reasons that a minimum of **20,560 tons of sediment** with at least 3 percent salt have been retained on BLM land due to road maintenance on OHV dirt roads.

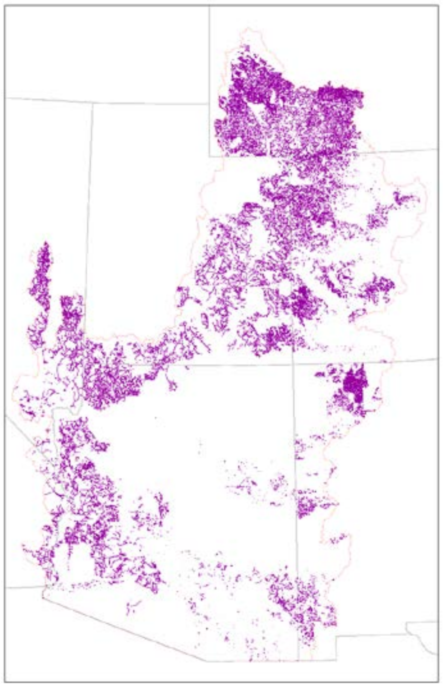


Figure 17 - BLM Recreation-OHV Program dirt roads that contribute to sediment transport within the CRB.

While the monitoring data from other programs continue to be updated, their numbers will be updated separately in the Salinity FAR. The total number of tons of salt retained solely by FY16 Salinity Program accomplishments is 48,971 for sustaining tons withheld and current FY16 tons retained due to Salinity Program accomplishments. The calculated contributions from Recreation-OHV for Roads for overall miles (20,560 tons sediment); FTEM (2,349) for FY15; and the ES&R Program for 11 BLM fires in CO and UT greater than 10,000 acres are being modelled for total sediment retained and FTEM numbers are currently being collected for other states for their contributions toward sediment reduction on BLM land within the CRB.

State	Current FY2016 tons of sediment retained	*Carryover of tons of sediment retained from FY2015	Cumulative Total	Adjusted FY2016 Total Tons of sediment retained from Salinity funded projects
AZ	547	7200	7747	51176
CO	0	6000	6000	
NM	15044	1900	16944	
UT	7125	8200	15325	
WY	1160	4000	5160	

*Carryover as has been calculated to date from Salinity-related program funds, subject to change

Total non-salinity related tons of sediment retained for 1x Recreation-OHV roads and FTEM (subject to updating) are 22,909. BLM total thus far for FY2016 is (22910 + 51176)=74086 tons retained.

STATE REPORTS

For FY2016, $1.5 million was allocated for BLM's salinity-control program through the Soil/Water/Air Program to support projects that met the criteria determined to be eligible for salinity control program objectives in the Upper Basin State Offices. Project funding is allocated toward proposals submitted by State Offices (AZ, CA, CO, NM, UT, WY) through the BLM Budget Planning System and prioritized for the WO SWA Program Lead with input from the Salinity Coordinator. Project funding is allocated toward proposals submitted by State Offices through the BLM Budget Planning System Funding. The budget allocation is predominantly distributed to implementation projects with some funding still given to planning projects according to need and availability of personnel to successfully accomplish project.

ARIZONA

ASFO/Salinity Control Structures: Structures built to slow runoff, salinity, erosion to Colorado River are now degrading (50 year lifetime). Supports the AZ Strategic Goal of Water for water quality. Project reports a minimum **312 tons of salt savings per year**.
Other continued structure repairs include:

1) Little Warren Dike #9. This is a forced account (fire) to repair a breached dike (54'L x 10'D). The work consists of laying back the sides of the breach, backfilling and compacting, then trenching and installing a gravel core. Due to the No-Go to the field restrictions our field time was cut back from 8 weeks to 3 weeks. The FA crew was able to lay back the sides of the breach then back-filled and compacted. **150 tons of sediment retained**
2) Upper Clayhole Valley Dike #8 Repairs - Force Account (Fire) to repair a breached dike (25'L x 6'D). The work consists of laying back the sides of the breach, back-filling and compacting, then trenching and installing a gravel core. Due to the No-Go to the field restrictions our field time was cut back from 8 weeks to 3 weeks. **85 tons of sediment retained**

Mittry MSU Salinity Control: Riparian buffer established in 2014. Soils tested across 80 acres of land and Mittry Lake; soil data indicate decreases in salinity concentration. The buffer continues to be managed.

COLORADO

White River Field Office (2008-2016): Summary of Activities
During the period 2008 to 2015, BLM Salinity funds (CRS Funds) have been used to add conductivity monitoring to existing USGS monitoring sites and support their reports based on data collected, purchase equipment, and fund seasonal workers for water resources field work. This funding continues to support the collection of baseline water quality and water quantity data at these stream sites. The previous agreement has expired and a new redirected agreement that includes groundwater monitoring with existing gages starts with FY17.

In 2016, CRS funding in conjunction with WO Regional Framework funds the following water resources monitoring efforts:

1. It supported the upgrade to the existing stream monitoring sites located on Piceance Creek, Yellow Creek, East Willow, East Douglas, and Black Sulphur. To date, a new site has been

installed on Upper Piceance Creek (Figure 18) and Lower Black Sulphur Creek (Figure 19) which currently are monitoring water temperature, stream depth, conductivity, and precipitation every 15 minutes. This provisional data is transmitted hourly via GOES satellite allowing access by any private and/or government agency via the Hydrometeorological Automated Data System (HADS) website (HADS network address request submitted). The current target is to install East Douglas and East Willow Creek monitoring stations and Yellow Creek too.

2. An YSI 9500 Photometer (Figure 20) purchased in FY15, was used to take measurements for samples collected. With the 9500 and the applicable reagent tablets, in-house testing of field water samples collected during each stream monitoring site visit are tested for alkalinity ($CACO_3$, HCO_3, and CO_3), chloride (Cl, $CaCO_3$, NaCl), magnesium (Mg and $CaCO_3$), sulphate (SO_4 and S), calcium (Ca), iron (Fe), and Phosphate (PO_4 and P).

The following is the list of publications resulting from CRS and Regional Framework funding:

1.Linard, J.I., Schaffrath, K.R., 2014, Regression models for estimating salinity and Se concentrations at selected sites in upper Colorado River Basin, Colorado: 2009 – 2012 (in publication process): U.S. Geological Survey Open File Report 2014-1015, 28p.
2.Thomas, J.C., Moore, J.L., Schaffrath, K.R., Dupree, J.A., Williams, C.A., and Leib, K.J., 2013. Characterization and Data-Gap Analysis of Surface-Water Quality in the Piceance Study Area, Western Colorado, 1959–2009. U.S. Geological Survey Scientific Investigation Report 2013-5015, 74p.
3.McMahon, P.B., Thomas, J.C., Hunt, A.G., Chemistry and age of groundwater in bedrock aquifers of the Piceance and Yellow Creek watersheds, Rio Blanco County, Colorado, 2010-2012: U.S. Geological Survey Scientific Investigations Report 2013 – 5132, 89p.
4.Thomas, J.C. 2015, (In Review), Characterization of Hydrology and Water Quality of Piceance Creek in the Alkali Flats Area, Rio Blanco County, Colorado, March 2012, U.S. Geological Survey Scientific Investigations Report 2015-xxxx, xx p.
5.USGS Briefing, Summary of select models for dissolved solids concentrations, White River Basin, northwestern Colorado, 1990 thru 2014, 2015, 8 p.
*The BLM also funded a data repository were completed to collect and assess existing water resource information (http://rmgsc.cr.usgs.gov/cwqdr/Piceance/). Data from the repository is being migrated to the Colorado Data Share Network (http://www.coloradowaterdata.org/).


Figure 19 - Upper Piceance Creek Monitoring Station


Figure 20 - Lower Black Sulphur Monitoring Station

Figure 18 - YSI 9500 Photometer-used to complete water quality analysis in-house

Characterization of the distribution and storage of sediments, salinity, and Se in Stinking Water Gulch near Rangely, Colorado

In many areas of western Colorado, the Cretaceous Mancos Shale Formation is present and a natural source of sediment, salinity, and Se to surface waters (Presser and others, 1994; Elliott and others, 2008). Anthropogenic activities can change the distribution and storage of sediment, salinity, and Se in and around channel areas (Butler and others, 1991, 1996; Hamilton, 1998; U.S. Department of the Interior, 1999; Lemly, 2002; U.S. Department of Interior, 2005). Understanding if and how some common land uses affect channel storage of these constituents has important implications to managers facing changing land use on Mancos Shale landscapes.

The USGS in cooperation with BLM are currently studying four basins on BLM managed lands that are geographically similar and represent different land use histories on areas of Mancos Shale. This study will help resource managers gain insight on how different land uses may affect sediment, salinity, and Se distribution and storage in Mancos Shale landscapes. The objectives of the project are to: (1) characterize sediment, salinity, and Se distribution and storage in four basins in Stinking Water Gulch under differing land uses (energy development and rangeland grazing); and (2) to evaluate the role of land use (energy development and rangeland grazing) and watershed processes that may increase sediment, salinity, or Se inter-basin flux.

The study includes four basins in Stinking Water Gulch near Rangely, Colorado (figs. 1-2). Two basins are dominated by energy development (Basin A1 and A2) and the other two basins are dominated by rangeland grazing (Basin B1 and B2). The basins in each basin group (A and B) include basins of similar size, aspects, soils, and slope. A comparison of sediment, salinity, and Se storage characteristics between these two basin groups will be used to evaluate the homogeneity of each system as well as test for significant differences between the two groups. This approach aims to provide insight into how different land uses affect the distribution, storage, and release of sediment, salinity, and Se in surface-water systems.

Task 1. Remote sensing images (1953-2013) have been used to evaluate the land use history of each basin and provide the timing and occurrence of changes in channel morphology (channel width, sinuosity, and drainage density). This information provides the temporal context of any observed changes in channel form that may be associated with land use changes or other disturbances within the surface-water system.

Task 2. Surveying was begun in September, 2015, in Basin B1, and will be completed for all basins in September, 2016. Surfaces derived from the surveying will be used to understand differences in channel geometry to facilitate assessment of storage of sediment, salinity, and Se for each basin. Surveying efforts will include up to 20 cross-sections in each of the basins in conjunction with an unmanned aircraft systems (UAS) equipped with a high-resolution digital camera. Utilizing Structure from Motion (SfM) topography mapping techniques, overlapping images from the UAS are combined using available processing software to produce Digital Elevation Models (DEMs) of each basin (Clark and others, 2013). Ground surveys and photographic control points, using GNSS-RTK survey techniques (Rydlund and Densmore, 2012), convert the digital elevation models into geographic coordinates for sediment volume calculations (bankfull channel and floodplain storage) and final DEM production. Results will be presented in a peer reviewed publication in calendar year 2017.

Task 3. At up to 5 locations in each basin, additional collection of sediment samples from terrace surfaces and the stream channel to determine salinity and Se concentrations and distributions will be completed in November, 2016 (fig. 3). Sample will be used to determine Se speciation in soils and shallow aquifer sediments using sequential extractions, which provide the best available means for studying Se speciation in solid phases (Zawislanski and others, 2003). Pronounced differences in solubility and bioavailability for the various Se species has led to the development of sequential-extraction protocols allowing quantification of Se abundances in operationally defined fractions (Kulp and Pratt, 2004). Sequential extractions of Se from these samples will be conducted using a protocol described by Kulp and Pratt (2004). The sequence of extractions includes (1) water-soluble Se, (2) exchangeable Se, (3) Base-soluble Se (humic/fulvic acids), (4) elemental Se, (5) Acid-soluble Se (carbonate), and (6) sulfides/selenides. All extracts will be analyzed for Se(IV) and total Se concentrations; all solid samples will be analyzed for total Se content. Water-soluble leachates will also be analyzed for major dissolved anions (chloride, nitrate, and sulfate), dissolved cations (calcium, magnesium, potassium, and sodium), and selected trace elements. Se analyses will be accomplished using hydride generation/atomic fluorescence spectroscopy in the USGS Central Minerals and Environmental Resources Science Center Laboratory in Denver, Colorado (Briggs and Crock, 1986).

Determination of the ages of geomorphic surfaces will be done using optically stimulated luminescence (OSL) techniques at the USGS Luminescence Dating Laboratory in Denver, Colorado, from samples collected in September, 2015, and November, 2016 (fig. 3). Use of OSL techniques can date sediments from 10 years to 175,000 years (USGS Luminescence Dating Laboratory, 2014). OSL sampling began in September, 2015, in Basin B1 and targets geomorphic surfaces that represent depositional setting along terraces and within the active channel to determine the erosional history of the streams.

Task 4. An assessment of hillslope erosion potential was begun December, 2015, using the. USDA developed Water Erosion Prediction Project (WEPP) model (USDA, 1995). The WEPP model is a process-based, distributed parameter, continuous simulation, erosion prediction model that is applicable to evaluate hillslope erosion processes (sheet and rill erosion), as well as simulation of the hydrologic and erosion processes on small watersheds. Comparisons of erosion predictions from the WEPP interface between the two basins and results of simulations using WEPP:Road will provide a comparison of the hillslope processes and transport rates of these two systems and can aid in understanding potential sediment inputs and erosion attributable to road and well pad disturbances associated with land uses in the area.

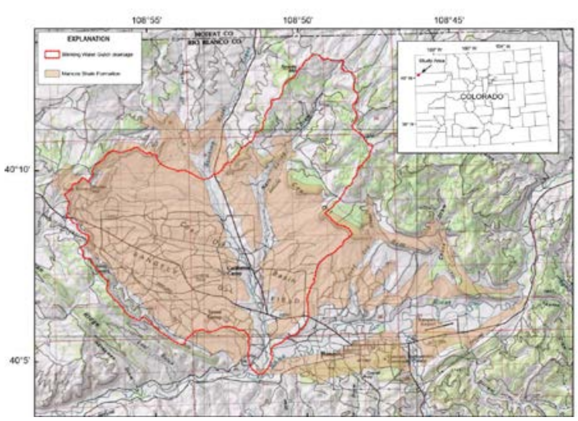


Figure 21 - Location of Stinking Water Gulch, Rio Blanco County, Colorado.

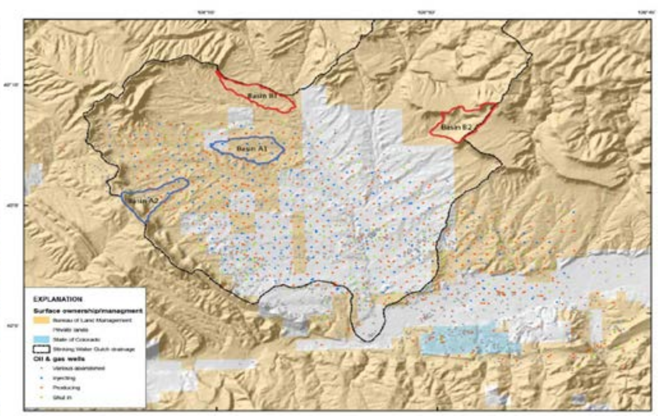


Figure 22 - Location of four selected basins in Stinking Water Gulch, Rio Blanco County, Colorado.

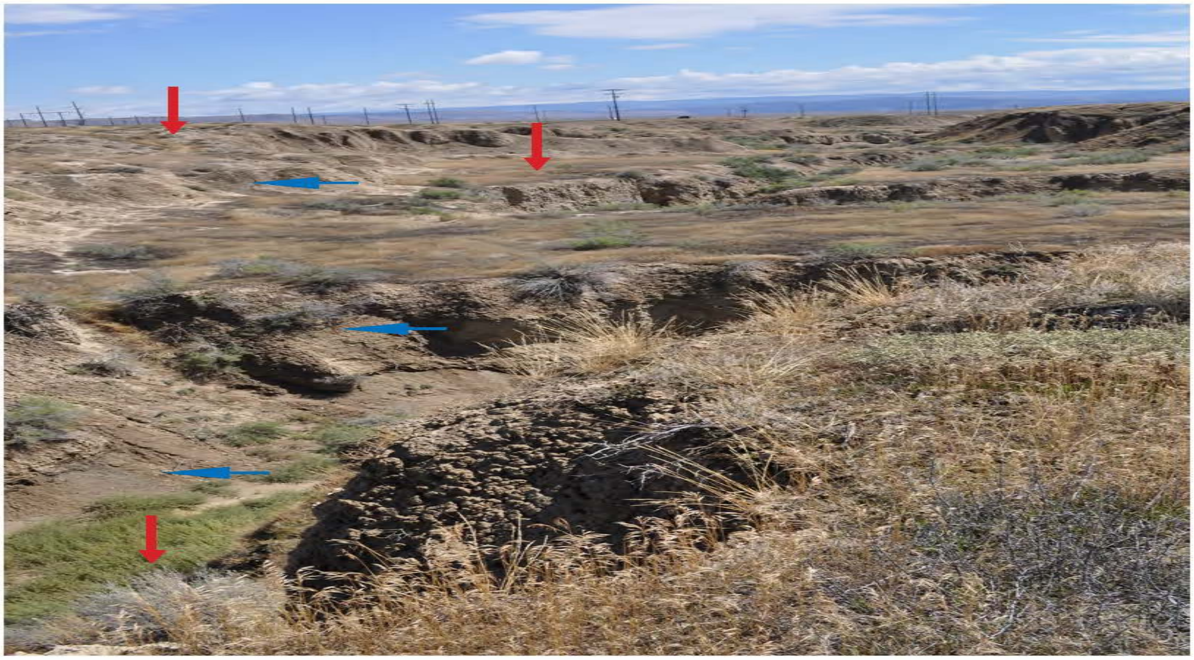


Figure 23 - Photograph showing example of multiple surfaces for age dating (red vertical arrows), and locations for sampling sediments for salinity and Se content (horizontal blue arrows), Rio Blanco County, Colorado.

Water Quality Data

The Colorado River Valley Field Office was awarded funding to have water quality laboratory work completed and partially support one AmeriCorps Volunteer (hired in partnership with the Middle Colorado Watershed Council (MCWC)), who have been successful at on-the-ground watershed assessment work and target accomplishments. A draft sampling and analysis plan has been written to address data gaps and initial field reconnaissance during the summer of 2016 included water quality sampling, discharge measurements, riparian and rangeland conditions assessments, and documenting historic mining impacts. A GIS analysis has been initiated to identify possible sources of Se and other impaired parameters, and formulate potential restoration efforts that may address load reduction goals.

Overview of the Middle Colorado Watershed Boundary showing the Water Quality Impaired or Monitoring & Evaluation listed stream segments. In FY14, BLM funding supported a comprehensive analysis of existing water quality data (2000-2013) and major findings and recommendations are waiting to be received. In FY15, BLM funding supported field reconnaissance and baseline watershed assessment work in the Rifle Creek sub-basin, water quality sampling and lab analysis, where data gaps had been identified. <u>Future funding has ceased until BLM receives these deliverables.</u>

NEW MEXICO

Approximately 1,076 acres of Federal land that was infested with weeds were sprayed to promote native vegetation recovery. Approximately 2,247 acres of weed treatment areas were monitored to establish the effectiveness of treatment. Farmington plans on applying Tebuthiuron to approximately 9,000 acres of sagebrush/grassland that had become unhealthy due to excessive

densities of sagebrush this fall. Funding has been allocated through the BLM/NMACD agreement for this project. Sagebrush in high densities tends to dominate the available soil moisture causing a loss of grass species and an increase in bare ground resulting in increased soil erosion. Tebuthiuron is applied at an appropriate rate to thin the sagebrush but not to eliminate it. Reducing sagebrush densities generally results in increased water availability for grass and forb species which typically increase ground cover and reduce soil erosion.

Ten acres of lop and scatter/ seeding have been completed with YCC crew with an additional 20 acres planned and funded for SCC Vet crew this fall. Funding and crew reservation for three weeks were finalized through the FFO/SCC agreement. Procurement of sediment capture fencing material allocated through the FFO/ NMACD, installation and maintenance of sediment capture fences planned and funded for the fall. Archeological surveys were conducted for 120 acres of pinon/juniper encroachment for a thinning/mastication project in the Simon Canyon Watershed. Work would begin as soon as agreement is written. Maintenance of existing sediment capture structures in the Largo Canyon Watershed and the La Manga Watershed are planned and funded for the fall. Approximately 200 acres of p/j thinning and mastication are planned for this upcoming fall.

<u>Silt Traps</u>- Approximately 60 Applications for Permit to Drill (APDs) have been approved this year so far. A common Best Management Practice (BMP) associated with the building of these well pads is the construction of silt traps to contain sediment runoff associated within the disturbance from the well pad and road construction. Each location generally had a minimum of one silt trap associated with it. Approximately 550 silt traps were built to help curtail sediment and salt loading and improve water quality in the San Juan Basin.

La Manga Salinity and Watershed Improvement
This will be the last fiscal year for funded project work in the La Manga Watershed. Maintenance of previous projects and this year's projects will continue for a period of time to ensure success of the treatments. Approximately 10-acres of pinon/juniper habitat was thinned and seeded to promote the restoration of an herbaceous cover of sufficient density to reduce storm water runoff and erosion using the BLM-FFO Fire Crew and YCC. An additional 20 acres are planned to be thinned by SCC this summer/fall. Salinity funding for this project has been allocated through an agreement with SCC. The approximate salt savings for this project, per year, is **13.5 tons**.

San Juan River Watershed Salinity Reduction and Vegetation Management
Rangeland health assessments have that some areas are lacking in understory plant growth. These areas have been identified for vegetation treatments to increase native understory recover. The funding for this project has been allocated through an agreement with NMACD to conduct aerial treatment of 9000 acres of decadent sagebrush communities lacking sufficient understories. The work for this project is planned for the fall. Sediment capture fence structures are planned to have maintenance done this fall as well. The estimated salt yield for this project will be **13,000 tons** by the end of FY16. Approximately 20 acres of riparian habitat has been improved through the use of natural stream bank armoring and seeding native grass species yielding an approximate **70 tons of salt retained.** Projects will continue throughout the year. Approximately 200 acres of p/j encroachment in the Simon Canyon Watershed are planned to be

treated using heavy equipment this year yielding an approximate **1100 tons of salt retained**. Three hundred acres of a previously treated area on Pump Canyon Mesa is planned to be reseeded to insure the success of the project. This will yield approximately **860 tons of salt retained**.

San Juan River Watershed Integrated Salinity Reduction Funding
This project has been allocated to purchase materials used for sediment capture fences. Two major structures in Largo Canyon and La Manga Canyon are planned to have maintenance and upgrades.

Colorado River Basin Salt Study
Funding for this project has been allocated towards the continuation of identifying land areas that contribute greatly to the amount of dissolved salts/solids to the Colorado River. Coordination between the BLM-FFO, USDA-ARS, and the University of Nevada for this project is continuing.

Figure 24 - YCC Crew Scattering Debris (La Manga)

Figure 25 - La Manga Project Area (Pre-treatment)

Figure 26 - Previous La Manga Lop/Scatter Complete

Figure 27 - Previous La Manga Project (Post-treatment) W/ Native Grass Recruitment

Figure 28 - Previous Teb Sagebrush Treatment 1

Figure 29 - Previous Teb Sagebrush Treatment 2

Figure 30 - Previous Teb Treatment (Post-treatment)

Figure 31 - Rincon Largo Dixie-Harrow/Seeding Project


Figure 32 - San Juan River Riparian Habitat Restoration/Seeding Project


Figure 33 - Recently Installed Silt Trap (Simon Canyon)


Figure 34 - Sediment Capture Fence Planned for Maintenance

UTAH

Uinta Basin Arid Land Study – Soil Salinity

The Uinta Basin, located in northeast Utah, is a structural and sedimentary basin about 115 miles wide at its widest point. Currently, there are 2,575 plugged and abandoned (P&A) wells in the Greater Uinta Basin Area (BLM staff, 2012). The BLM Green River District (GRD) has issued reclamation guidelines for lands managed under its administration that involve the development of a reclamation plan for all surface-disturbing activities (BLM GRD, 2011). The long-term goal of the reclamation plan is to "facilitate eventual ecosystem reconstruction by returning the land to a safe, stable, and proper functioning condition", and the short-term goal is to "immediately stabilize disturbed areas and to provide the necessary conditions to achieve the long-term goal". The BLM Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development "The Gold Book" (USDOI and USDA, 2007) provides information on permitting requirements and approval, and conducting environmentally sound oil and gas operations on federal lands – operations such as exploration, production and reclamation. Reclamation involves restoring the original landform or creating a landform that approximates and blends in with the surrounding landform, involves salvaging and reusing all available topsoil, revegetating disturbed areas to native species, controlling invasive nonnative plants and noxious weeds, controlling erosion, and monitoring outcomes (USDOI and USDA, 2007). Reclamation is considered successful when a "self-sustaining, vigorous, diverse, native (or otherwise approved) plant community is established on the site, with a density sufficient to control erosion and non-native plant invasion and to re-establish wildlife habitat or forage production" (USDOI and USDA, 2007).

The nature of the soils in the Uinta Basin present a challenge to successful reclamation of P&A well pads. The rating of these soils as potential topsoil resources and reclamation materials for revegetation is poor to fair (mostly poor) due to factors such as elevated salinity, high sodium content, high alkalinity, low organic matter content, shallow depth to bedrock, and high rock content (USDA-NRCS Staff, 2003). In addition, drilling operations can lead to soil compaction and the addition of drilling related chemicals to well pad sites. Such disturbances, in conjunction with the limited availability of water in semi-arid environments, makes reclamation more challenging and often favors the establishment of invasive weeds like *Bromus tectorum* L. (cheatgrass) over native species desired for revegetation (Eldridge et al. 2012).

Utah State University (USU) has been conducting field surveys of plugged and abandoned (P&A) well pads in the Uinta Basin since 2011. To identify the factors that were limiting restoration success, fifteen sites of various ages and surface geology were randomly selected. Sites were partitioned into three zones A (upper Myton bench), B (Pariette Wetland), and

C (lower Myton bench). Y-transects were established on each site. Sites consisted of P&A well pads and adjacent undisturbed sites. Each transect arm was 200 feet in length and offset by 120 degrees with each adjacent arm. Five soil samples were collected at equal distances along each transect line. Soil samples were analyzed for bulk density, pH, texture, salinity (ECe), organic carbon content, sodicity (SAR), metals, and petrochemical hydrocarbons. Ground cover and vegetation species were noted every foot along the 200 foot transects. Results of the field surveys indicate that the greatest factors limiting the successful restoration and revegetation of P&A well pads by desirable native species are lack of soil water, soil salinity and sodicity, shallow soils, and soil compaction. The three main invasive weed species found on P&A well pads are halogeton, cheatgrass, and Russian thistle.

Two different pedons of the Pariette Draw were examined on September 17, 2011: one was located in somewhat poorly drained soil inundated by irrigation return flow at the margin of the wetlands (1448 m), and the other was located in an upland area (1467 m) within the Pariette Draw (Figure 1). Sites were selected in stable undisturbed areas with representative native vegetation. The wetlands margin pedon was located downstream of the inlet to Pariette Wetlands below the Flood Control structure. The upland pedon was located upslope of the BLM compound building, and was not influenced by the inundation of water that created the current wetlands.

The chemical properties of the upland and wetlands soils, especially with regard to the quantity and distribution of soluble salts in each profile, differed considerably. Hydrology was the main factor responsible for the difference in accumulation and distribution of soluble salts between the two soil profiles. The upland soil profile was typical of a well-drained, arid soil, where soluble salts and carbonate concentrations increased with depth due to a downward translocation of these materials transported via a gravity-driven hydrology. The ECe for the upland soil ranged from 0.5 to 2.6 dSm^{-1}, which is not extraordinarily high.

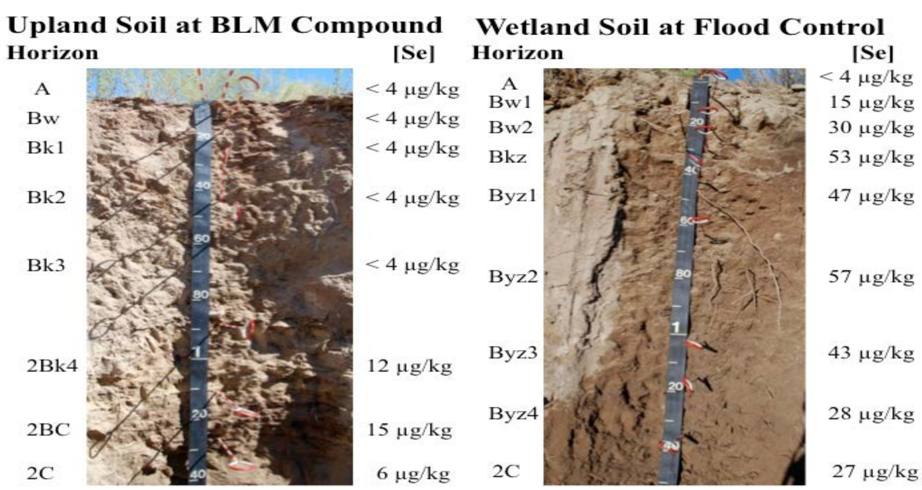


Figure 35 - Photos of soil profiles of Wetlands and upland soils of Pariette Draw, Utah

Significant physical and chemical properties of the upland and wetlands soils differ as a result of alteration of the water table due to irrigation return water. Soluble Se concentrations were associated with soluble salt, and soluble salts levels were more than one order of magnitude greater in the

wetlands profile than the upland profile. It appears that hydrology of the Pariette Draw is regulating the solubility of Se, sulfate and Fe within the soils profiles. Capillary migration was responsible for the translocation and accumulation of salts in the upper horizons (Byz horizons; 28 to 131 cm) of the wetlands soil, while lack of soluble salt and the distribution of calcium carbonate equivalents in the upland soil reflected downward translocation, typical of soils formed in arid climates. Within the Byz horizons of the wetlands soil, soluble salts were composed mostly of sulfates. Gypsum solubility regulated sulfate levels within the Byz horizons. Surface salt crusts within the wetlands soil were identified as thenardite (XRD and geochemical modeling). We surmised that soluble Se was most likely regulated by the solubility of a mixed sodium selenite-sulfate co-precipitate. It appears that the relatively low concentration of Se in the Pariette Wetlands soil was not the source and cause of Se responsible for adversely affecting wildlife in the wetlands. Instead, it is the exposure of water containing an elevated level of Se flowing through the wetlands that most likely is the source of Se negatively impacting animals.

Additionally, two oil and gas exploration sites within the Pariette Draw watershed were evaluated for soil quality parameters. The sites were (a) a 2.8 ha plugged and abandoned (i.e., disturbed) oil and gas well site (40^{o} 1'46.04" N, 109^{o}47'31.38" W) and (b) a 2.1 ha undisturbed site (40^{o} 1'38.08" N, 109^{o}48'21.95" W). Both the P&A well site (~ 1,436 m above sea level) and the undisturbed site (1,443 m above sea level) are approximately 1.23 km apart and are located on the west side of the Pariette East Dike Reservoir.

Electromagnetic induction sensing technique was successful at identifying "hotspots" associated with limited re-vegetation success on a P&A well pad sites. These hotspots were specifically related to soil compaction, excessively high salinity levels, and soil sodicity, which influenced the quantity, quality, and diversity of surface vegetation cover. Due to the oil and gas drilling and extraction activities, land cover distribution changed significantly in favor of bare surface (82 percent), with the remaining portion comprising almost entirely of undesired plant species (13 percent). Disturbance and subsequent reclamation of the P&A well pads resulted in a redistribution of salts in the soil profile, with increased levels of salinity at the soil surface, which promoted the bareness of the soil surface (Figures 2-4).

Within a 24-m radius around the P&A well-head, the soil surface was predominantly bare, more saline, more compacted, with higher sodium concentration and SAR values than farther away. The DOC followed a similar pattern, which indicates that the DOC provides a quick and relatively inexpensive measurement to ascertain the presence of petroleum residues in the P&A well pads. High correlations between depth-weighted ECa and these potential limiting soil properties (such as ECe, SAR, Na content), implied that the spatial patterns of the cost-effective ECa data could be used to guide the restoration of these soils. In addition, the similarity in the spatial patterns between ECa and the soil properties, suggest that more reclamation efforts be handled in a site-specific manner and more emphasis should be placed in areas near the well-head.

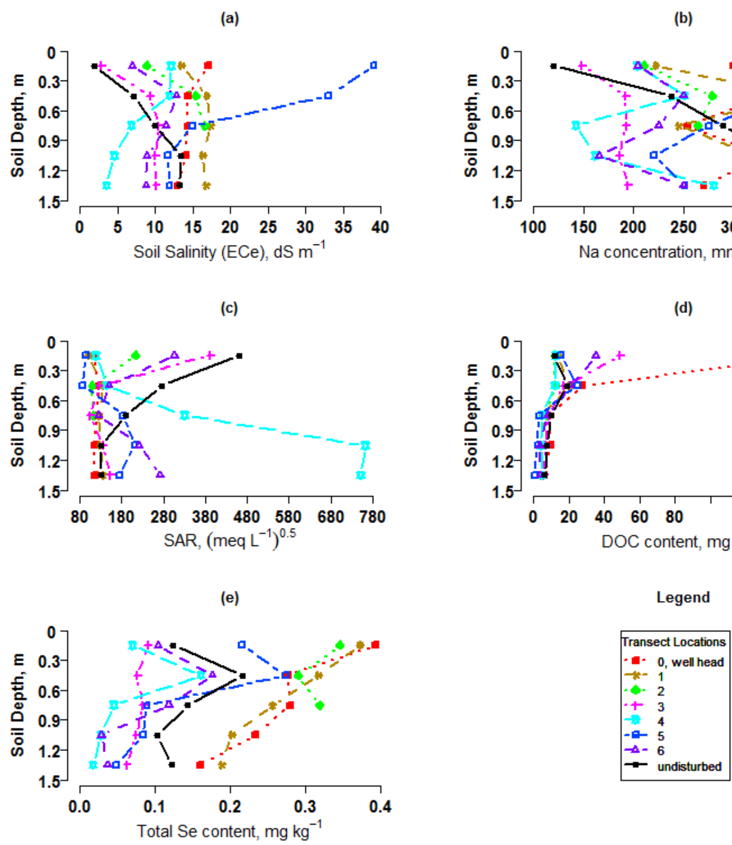


Figure 36 - Depth profile variation of soil properties in a plugged and abandoned well site (denoted by dashed and dotted lines with seven characters types), plotted with reference to an undisturbed site (denoted by a black solid line and shaded circle type). The black line/shaded circle represents the average soil property value at that depth calculated from all seven transect points. Each of the other colors (i.e., red, gold, green, pink, lemon, dark yellow, and purple) represent a particular point (i.e., 0, 1, 2, 3, 4, 5, and 6) along the three transects. The depth locations are plotted at the midpoint of the five sampled depth interval (i.e., 0.15, 0.45, 0.75, 1.05, and 1.35 m)

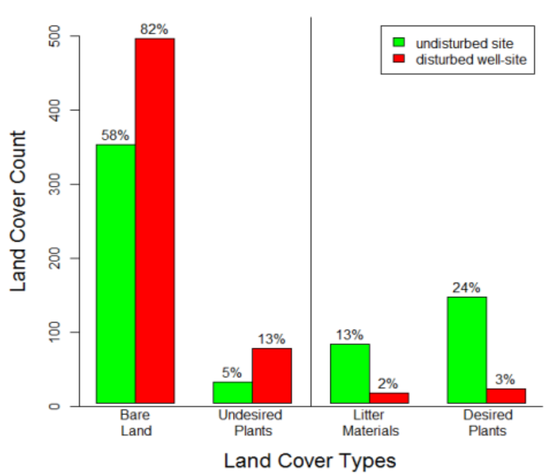


Figure 37 - Influence of land disturbance by oil/gas drilling on the distribution of land cover types (such as bare land, plant canopy quality, plant desirability, and litter material) in a plugged and abandoned well-site with reference to an undisturbed site within the Pariette Draw watershed in Utah.

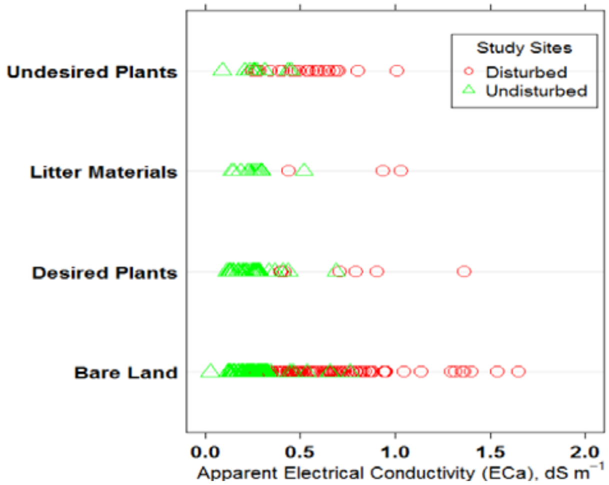


Figure 38 - Relationship between soil conductivity (ECa) from an electromagnetic induction survey and land cover types (such as bare land, plant canopy quality, plant desirability, and litter material) in a plugged and abandoned well-site (i.e., red-colored circles) and an adjacent undisturbed site (i.e., green-colored triangles) within the Pariette Draw watershed in Utah.

Grazing Exclosure Project

The Moab Field Office manages an ongoing grazing exclosure project related to saline soils and long term monitoring efforts. The overall goal of this project is to quantify impacts from grazing actions on moderately saline soils including increased erosion rates, decreased vegetation cover, decreased nutrient cycling and increased salinity loading to the Upper Colorado River Basin.

The Moab Field Office includes 315,000 acres of moderately saline soils, mainly derived from the Mancos Shale Formation. In order to better understand the range of impacts from different grazing systems on saline soils, the BLM has been constructing grazing exclosures and conducting baseline data collection efforts adjacent to existing long-term range study sites. We are collaborating with USGS, to collect and analyze soils and vegetation data from both inside and outside these exclosures.

The fencing supplies are approved for purchasing and will be stored in the ware-yard until needed. The local Canyon Country Youth Corps has been a great partner on this project, and have constructed many of the new 5-acre grazing exclosures. Construction is scheduled for the spring of 2016, a delay due to scheduling conflicts. Interns hired by ACE will plan and coordinate exclosure construction along with collecting field data over the next year.

The information gained will help the Moab Field Office manage grazing activities on moderately saline soils to ensure good and stable watershed conditions and minimize salinity contributions to the Upper Colorado River Basin.

Ongoing Protection Fencing in Ten Mile ACEC

The Ten Mile Wash Area of Critical Environmental Concern (ACEC) is located northwest of Moab and drains into the Green River. This 5,000-acre area contains perennial and intermittent stream flows that maintain ecological diversity in both upland and riparian zones. Ten Mile Wash is subject to extreme flooding, increasing potential safety hazards to vehicle and camping activities. The potential for floods is great because the Ten Mile Wash watershed basin drains 176,000 acres. The canyon bottoms are filled with moderately saline soils which are extremely mobile and are redistributed during flood events.

The Moab Field Office received funding in FY16 for this project. This funding went to an assistance agreement with American Conservation Experience (ACE) to monitor 5,000 acres of Ten Mile ACEC which is constantly struggling with trespass cattle and illegal off road travel. These actions are impacting the ecological values of the ACEC as well as the moderately saline soils throughout the canyon bottom. Watershed conditions are monitored and documented, while additional fencing needs and their construction are assessed. This is in a very remote area with little vehicle access, so all materials and tools are hand carried to each site.

Figure 39 - Ten Mile Wash ACEC, closed trails and trespass cattle use in saline soil area.

Eight Mile Salinity Control Structure

The Grand Staircase-Escalante National Monument received Salinity Program awards to continue repair and maintenance work on the Eight Mile Salinity Control Structure. Recently, the dam was extended approximately 150 feet, the spillway was repaired and armored with geotextile material and rip-rap, and approximately 15,000 cu yd **(4050 tons)** of salt-laden sediment was excavated from the control structure's primary settling pond to restore the holding capacity of the reservoir.

Figure 41 - Eight Mile Impoundment before excavation

Figure 42 - Eight Mile Impoundment after excavation.

Figure 40 - Eight Mile Impoundment with water July 1, 2016.

In 2016 the Eight Mile Salinity Control Structure collected sediment and water during the summer 2015 monsoon rains. As of July 1, 2016, the pond was inundated with water so it was not possible to measure the depth of sediment that accumulated during the previous year. However, based on a 40 year average of 0.4 feet of sediment retention per year the **estimated salt reduction was approximately 28.7 tons in 2016**.

Telegraph Flat and Finn Little Wash Salinity Control Structures

In 2016 the Grand Staircase-Escalante National Monument received a Salinity Program award to repair and maintain salinity control structures within the Monument boundary. Five salinity control structures were identified for repair and maintenance on Telegraph Flat (Telegraph Flat 1-4 and Finn Little: see map below), north of Hwy 89 at the southern end of the Monument. Clean out of the Telegraph Flat and Finn Little Salinity Control Structures was conducted during

the week of June 27, 2016.

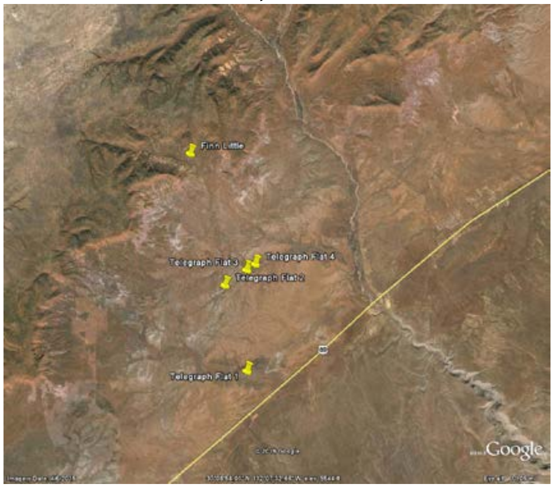


Figure 43 - Google Map Imagery of Telegraph Flat and Finn Little Wash Salinity Control Structures

Telegraph Flat 1:
Telegraph Flat 1 consists of two adjacent ponds that were full of sediment. Both reservoirs were filled with sediment and the dam was breached. Approximately **1067 cu yd (288 tons)** of sediment was excavated from the two ponds and used to repair the breached dam and reinforce the dike structures. The last clean out date was unknown so the annual salinity load was not estimated.

Figure 44 - Telegraph Flat 1 before excavation.

Figure 45 - Telegraph Flat 1 before excavation.

Figure 46 - Telegraph Flat 1 during excavation.

Telegraph Flats 2 through 4
Telegraph Flats 2, 3, and 4 consists of three consecutive gully plug salinity control structures installed in a gully that drains an intermittent stream to Clay Hole Wash. The Telegraph Flat 2 and 3 structures were functioning but were full of sediment. The dam had been breached and blown out at the Telegraph Flat 4 structure and was in need of repair. In addition, the Telegraph Flat 4 retention pond was full of sediment. Telegraph Flat 2-4 were previously cleaned out in 2012 but have since filled in with sediment. Sediment was cleaned out of the three ponds and used to reinforce the dam structures. The blown out dam at Telegraph 4 was also repaired. During the current cleaning we estimated that approximately **5,051 cu yd** (**1364 tons**) of salt-laden sediment was removed from the three salinity control structures, constituting an average of **85 tons of salt retention per year over the past four years (total of 340 tons).**

Figure 47 - Telegraph Flat 2 before excavation

Figure 48 - Telegraph Flat 2 after excavation.

Figure 49 - Telegraph Flat 3 before excavation.

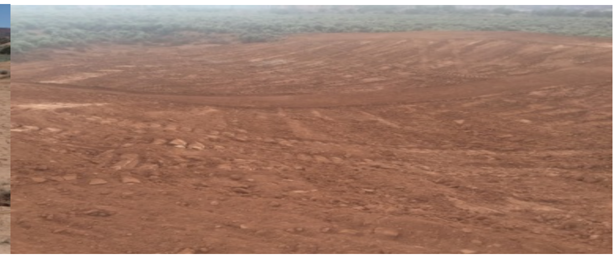


Figure 50 - Telegraph Flat 3 after excavation.

Figure 51 - Telegraph Flat 4 before excavation. (Note: approximately 20 ft gully where the dam was blown out.)

Figure 52 - Telegraph Flat 4 after excavation and dam repair.

Finn Little

The Finn Little Salinity Control Structure is a gully plug located on Finn Little Wash. The structure has not been maintained for many years and the pond was filled with sediment and the dam was blown through. Sediment was cleaned from the pond and used to reinforce the dam structure and repair the blown out portion of the dam. During the current cleaning we estimated that approximately **3,129 cu yd** (**845 tons**) of salt-laden sediment was removed. The total salt retained prior to the dam being breached was approximately **209 tons**; however, we were not able to estimate the annual load since the last cleanout date is unknown.

Figure 53 - Finn Little dam before repair. (Note: the deep gully where the dam was blown out.)

Figure 54 - Finn Little after during excavation and dam repair.

WYOMING

2016 High Desert District Salinity

Assumptions: for purposes of comparison the following assumptions were made for the calculations presented. A Work Month costs $8500 unless otherwise stated; the soil averages about 3 percent salt by weigh; the average bulk density of soil is 2.65 g/cm^3 (165.4 lb/ ft^3) (7640 lb/yd^3); 2 yd^3 of soil are retained per mile of road maintained; 0.5 ac-ft of soil saved per reservoir maintained; the life of a reservoir is 10 years; prescribed and wild fires cause a short term increase in erosion and salt production; with vegetative regrowth result in a salt savings of about 1 yd^3 of soil retained per acre burned; 3 ft^3 of soil retained for each acre properly managed for domestic grazing; 3ft^3 of soil retained per acre of reclaimed land.

The following information is a summary of actions taken by the BLM Field Offices (FO) in the southwestern corner of Wyoming in the Green River basin including *Rock Springs, Rawlins, Kemmerer, and Pinedale.*

Specific Projects

Nonpoint Sources (NPS)

Nonpoint salinity sources are addressed through regular maintenance of BLM roads, structures and reservoirs. Salt savings from NPSs are difficult to estimate both in terms of volumes of salt retained and costs. The range of soil and precipitation conditions and including the true costs of labor and materials adds to the uncertainty in estimations of dollars spent per tons of salt retained. Nonetheless, it is vitally important that these activities continue as NPS erosion is the dominant path of terrestrial salt entrainment into the surface water system. Southwest Wyoming experienced several energetic high flow events in the spring of 2016. A variety of activities were undertaken in the High Desert District's (HDD) portion of the CRBs as part of normal activities in FY 2016 that have a secondary impact of reducing NPS erosion.

1. Road Maintenance

(2 work months); 350 miles*2 cu yd/mile*7640lb/yd^3*0.03lb salt/lb soil *ton/2000 lb = **80.2 tons of salt;** ($8500 * 2)/802 tons of salt= **$21.20/ton of salt**

2. Reservoir Repair

Four reservoirs were repaired in 2016 at a cost of two work months 0.05 ac-ft of soil saved per reservoir maintained; A Work Month costs $8500; One Acre =43,560 sq ft 4 Reservoirs *0.5 ac-ft/Reservoir* 43560 ft^2/acre* 165.4lb/ Ft^3 * 0.03 lb salt/lb soil* ton/2000lb = **216 tons salt;** $(8500*2)/216 tons of salt = **$78.70/ton of salt**

3. Structures

Pierotto Drop Structure

The Pierotto Drop structure is under construction from August through October, 2016. The Sweetwater County Conservation District (SWCCD) is the lead agency that is coordinating between the BLM, Sweetwater County, Anadarko Petroleum, Black Butte Coal Mine, Bridger Coal Mine, the town of Rock Springs, and the State of Wyoming. Although the existing structure and its potential replacement are not on BLM managed lands, the BLM participates due to the potential of degradation to adjacent BLM managed lands.

The purpose of the project is to maintain the existing location of the headcut, prevent future degradation of the stream channel, maintain existing water tables, and retain salts within geologic deposits. The cost of the structure itself is estimated at $353,000. Assumptions for initial calculations: drop height 20 ft, and drop width 200 ft, potential advancement of drop (post failure) in one year 1 mile (5280 Feet) (would move onto BLM land). This 20 Ft High * 200 ft wide * 5280 ft * 165.4 lb soil/ft^3 * 0.03lb salt/lb soil * Ton/2000 lb = 52,399 Tons Salt retained (<u>not</u> added to BLM salinity totals); $353,000/52,399 tons salt = $6.74/ton salt.

Figure 55 - Overview Pierotto Drop Structure

Figure 56 - Pierotto Diversion May 9, 2016

Figure 57 - Pierotto Diversion June 2, 2016

<u>Muddy Creek Structures</u>

Failing grade control structures on East Muddy Creek has led to vertical instability, stream bank instability, in-channel erosion, and risk of irrigation structure failure. As a result of the erosion, instability and channel down cutting, excessive amounts of sediment and salinity are being introduced into the system as well as fish passage is inhibited. This project would reduce erosion, sedimentation and salinity loading as well as restore fish passage to this proposed reach by removing failing gradient control structures and replacing them with several, smaller step-pool structures. The step-pool structures would be constructed using soil, large rock and logs. Assumptions: Drop height of 5 ft, drop width of 10 ft. Potential advancement of drop (post failure) in one year 1 mile (5,280 Feet). This calculation assumes advancement of the full width of the headcut and does not take into account the potential additional salts that could be introduced through tributaries and the reductions in water table elevations. 5 Ft High * 10 ft wide * 5280 ft * 165.4 lb soil/ft^3 * 0.03lb salt/lb soil * Ton/2000 lb = **655 tons salt;** $80,000/**655 salt = $122.14/ton salt**

Figure 58 - Muddy Creek step-pool structure

4. **Fire Rehabilitation –** The late spring runoff in 2016 has delayed the onset of fire season. At the time of this report, there are no fires to report.

5. **Grazing Management** - 28,000 acres of land managed; Assumptions: Cost about 20 work months = $170,000 (Additional benefits to public lands also obtained). 28,000 acres evaluated * 3 ft^3 soil/ac * 165.4 lb soil/ ft^3 * 0.03 lb salt/lb soil = 416,808 lb of salt =**208 tons of salt;** Cost $170,000/208 tons of salt = **$817/ton of salt.**

NATIONAL OPERATIONS CENTER

The following projects have received funding from both the Basin States and the BLM Salinity Programs:

The BLM NOC, especially the Salinity Coordinator, has been collaborating with USDA ARS and the UN-Reno for the Rainfall Runoff plots, as has been established in previous FARs but also for the hydrologic and erosion response to vegetation cover gradient to vegetation on semi-arid hillslopes. The same rainfall-runoff plots were used. The significant findings have been that sediment concentration at steady-state was inversely controlled by litter cover while steady-state discharge was comparable across canopy cover groups. The 3D data suggests that vegetation reduced net sediment delivery from the plots by primarily increasing opportunities for deposition while marginally affecting gross soil erosion. This 3D data clearly demonstrated the positive effect of slope on sediment delivery ratio.

To further understand sediment transport processes on saline rangeland hillslopes in communities in the CRB, we have undertaken rainfall simulation studies regarding flow detachment and deposition. The data collected are providing the physical parameter values for various soil types for physically-based models that will assist in the quantification of BLM management programs. The rainfall runoff studies funded have shown the extent of channel networks and demonstrated a positive function of slope, discharge and vegetation. Vegetation may deflect runoff in many flow paths but they promoted deposition. These rainfall studies led by the USDA ARS and UNR suggest that effective runoff soil and salt load reduction strategies should aim to promote deposition of transported sediments rather than reducing detachment which are likely unfeasible in these resource-limited environments.

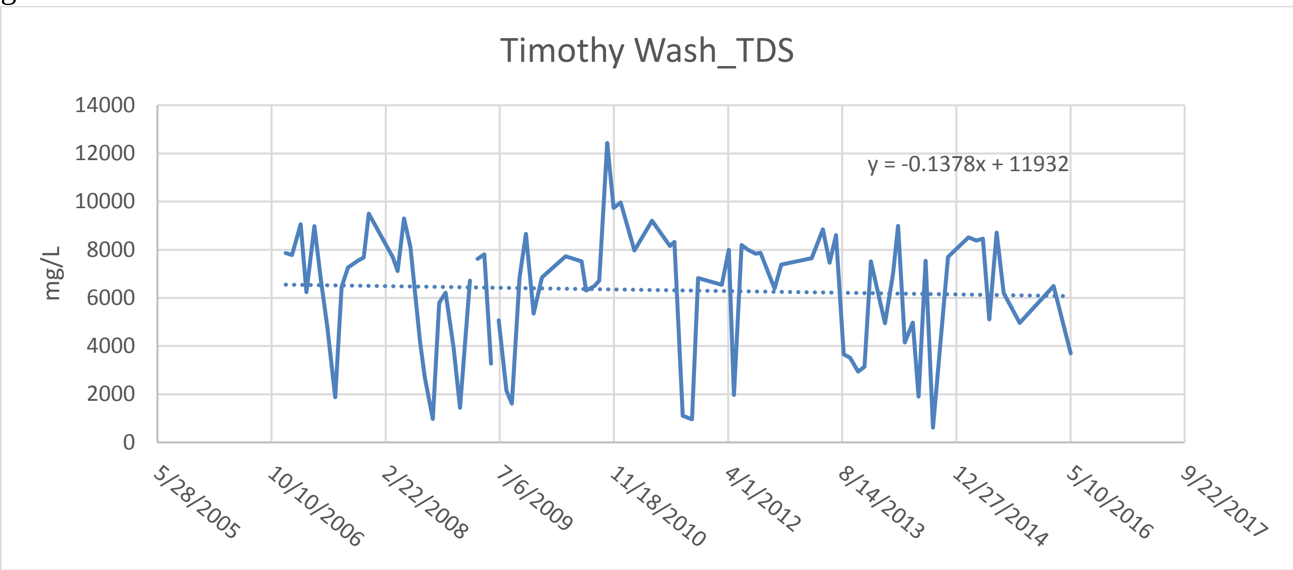
Bureau of Reclamation
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2016

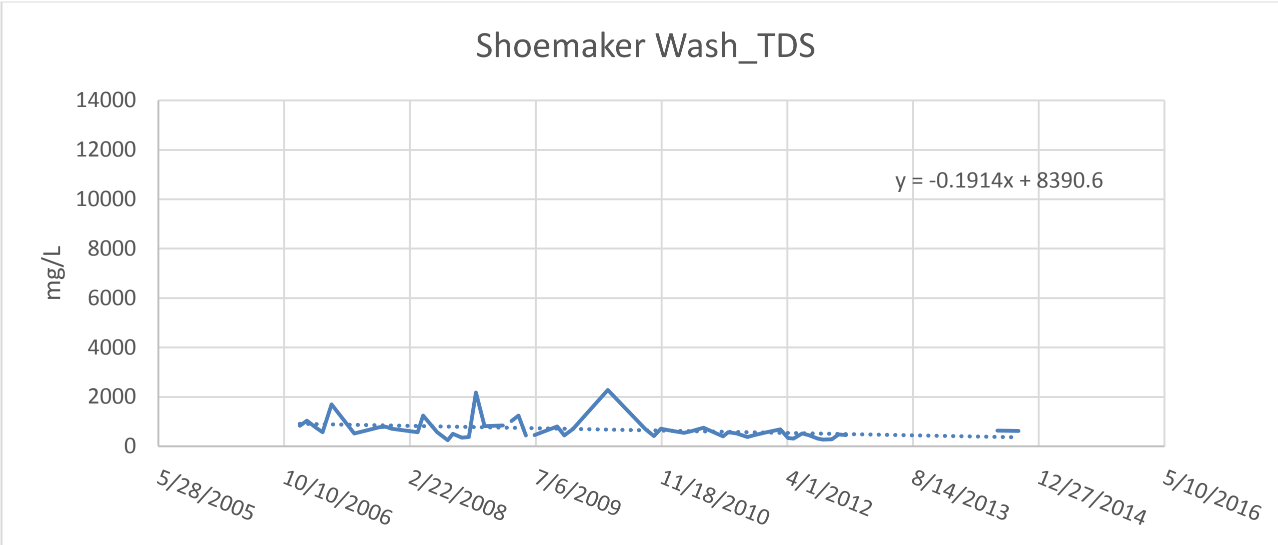
Desert Lakes Monitoring

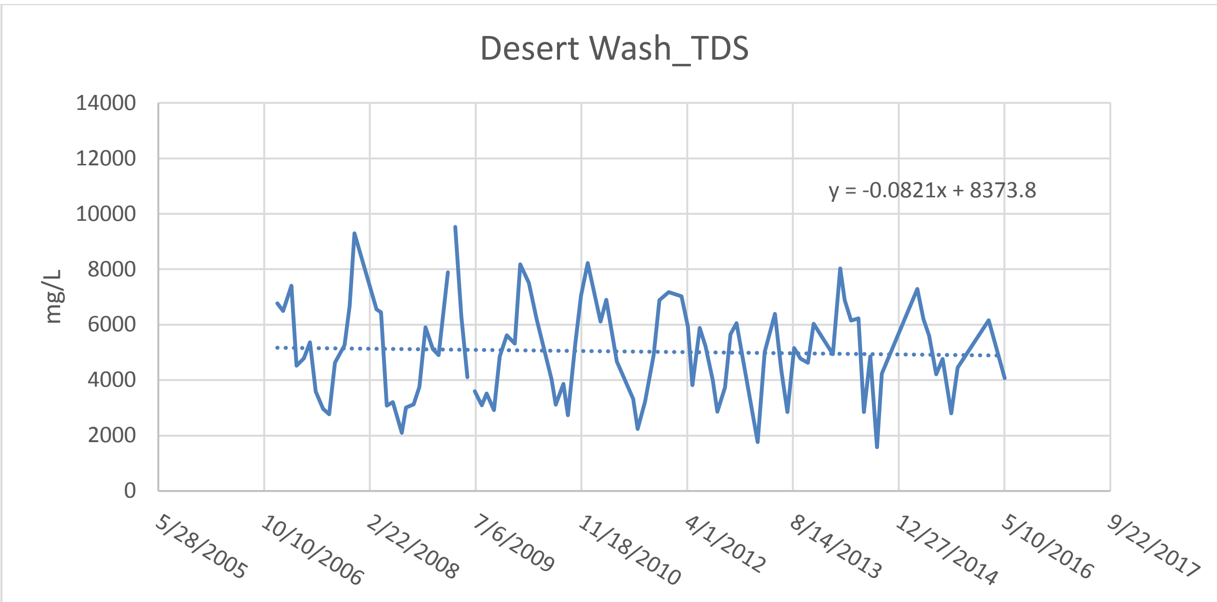
The monitoring of the Huntington Cleveland Project drainage basins has continued this year. As the pressurization of irrigation water is mostly complete, the monitoring of surface waters in the three washes (Timothy, Shoemaker, and Desert Wash) as well as adjacent wells has been reduced to once per quarter over the current year. The Desert Wash Complex has also continued to be monitored on the same schedule.

Over the salinity project's build, the elevation of the groundwater in these three basins has dropped thus causing an increase in TDS in the groundwater. The salt does not reach the surface as often since the water table is now lower. In the case of Shoemaker Wash, the surface water is now seldom flowing and the canal is dry except on the occasion of a large storm.

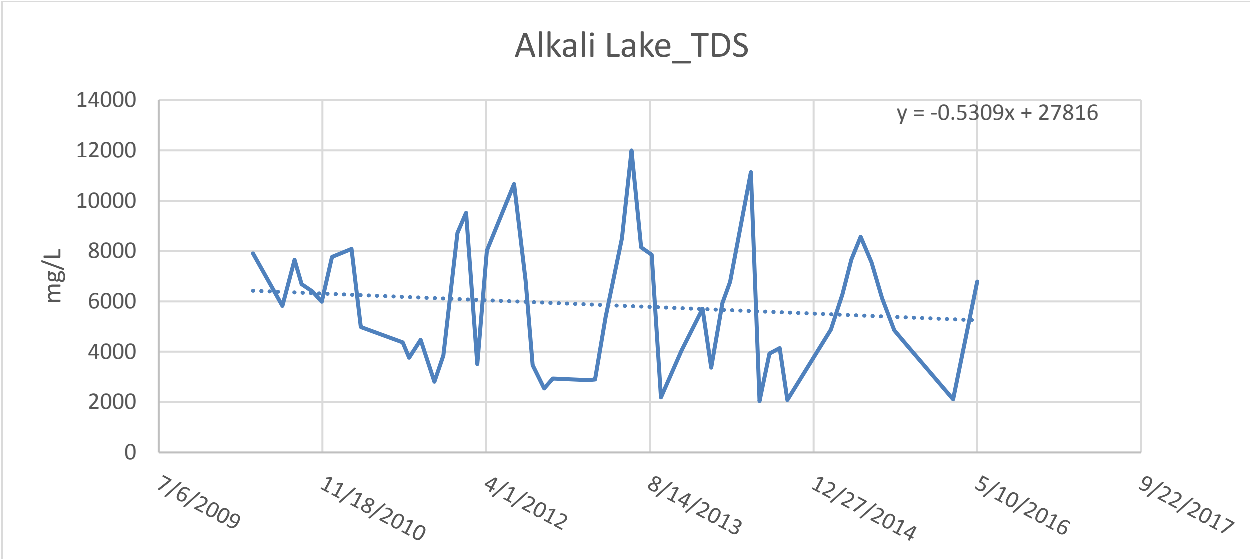
Over the course of the project, it was determined from monitoring locations along the canals and the adjacent wells that the groundwater flows from the surface water to the groundwater. There is less water in the surface water system because the amount of runoff from the flood irrigation has been minimized. The TDS Levels through the various surface flumes has shown a decline that is being attributed to the pressurization of the irrigation systems in the area and lower groundwater elevation.





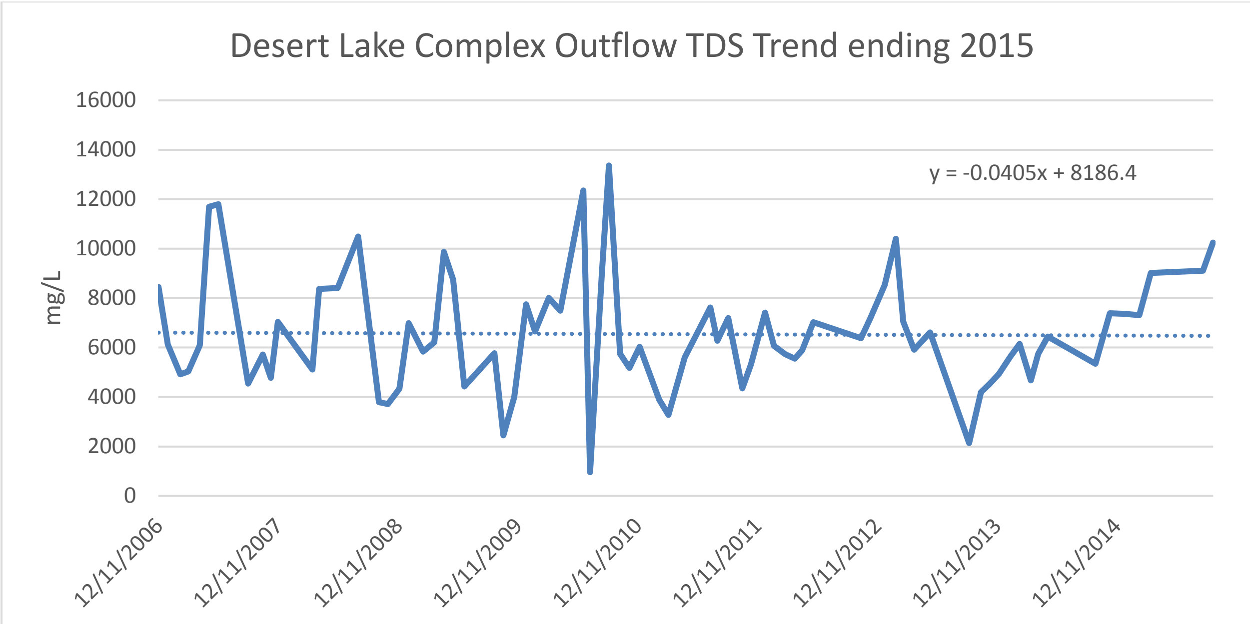


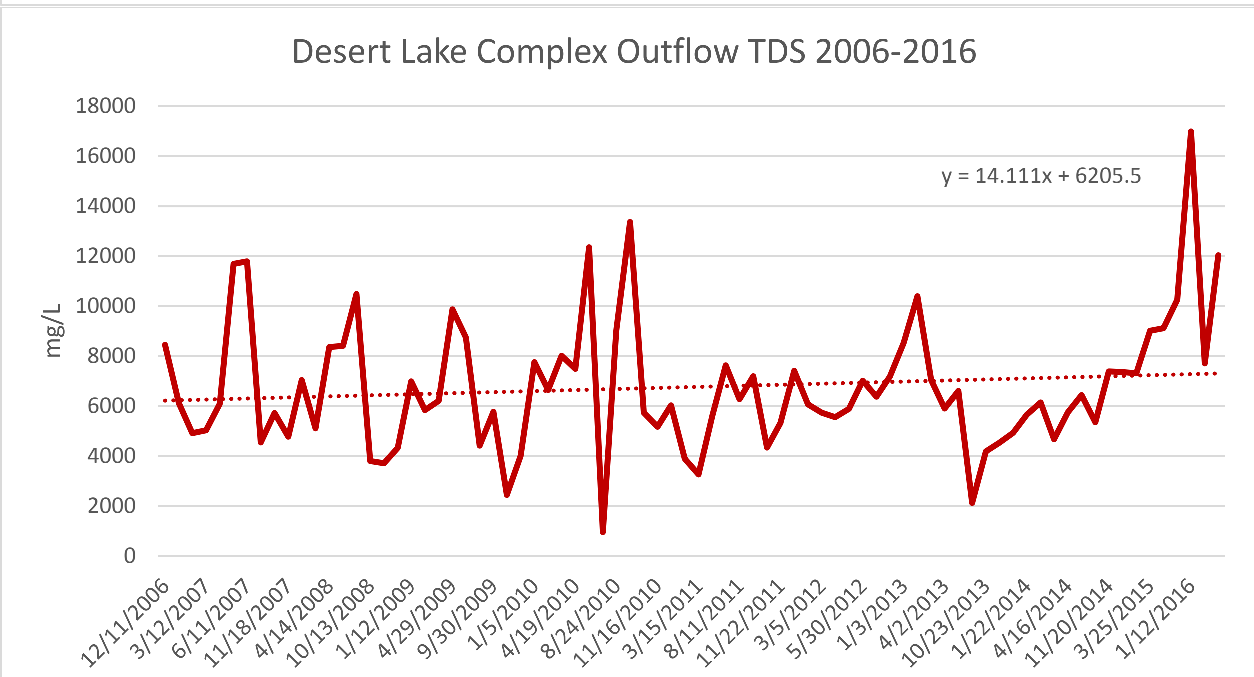
At the point where all three washes meet, Alkali Lake (part of the Desert Lake Complex), there has also been a decrease in TDS. This lake was not monitored routinely until 2009. Alkali is the highest of the main six lake system with only Tamarisk Lake (a seventh) above it. Tamarisk Lake is fed by Timothy wash and generally follows TDS levels of that wash before emptying into Alkali Lake.



The monitoring program was set up to monitor the drainage basins as well as the Desert Lake Complex under the assumption that improved water going in would result in improved water leaving the system and entering the Price River system and improve it. At the present time, that has not been the case. Desert Lake Complex is a dynamic entity that is under the influence of weather, natural disasters-forest fires, inflow from irrigation runoff and precipitation, and human manipulation.

The flow between the various lakes are controlled by Utah Department of Natural Resources (DNR). They have set goals to better manage the area for wildlife in the past 2-3 years. There has also been a large shortage of water in the Desert Lake Complex due to the decrease in irrigation runoff. The DNR has been rotating water in the various lakes to control invasive fish such as Carp and have used the time when lakes are empty to install new outlet structures. The complex is built upon an area of Mancos shale and as the lakes fill and empty, the salt levels in the ground water come to the surface and remain just as in the farmer's field. As the water supplied to the lakes increases and dissolves the salt on the surface, the outflow, if water is outflowing, will be higher in TDS. The Desert Lakes Complex will need to reach a point where the water kept in the complex is fairly consistent. The previous 2 years have been very dry for the complex as the irrigation system has been pressurized and they no longer have as much flow into the system. The outflow has been relatively nonexistent so there has been little salt entering into the Price River. The DNR is learning to better manage the water under the diminished supply and they are starting to fill the lakes. Now as the water level increases enough to leave the system it is actually higher in TDS as shown in the graphs below.





TDS Forecast Modeling

The Water Operations Group of Reclamation publishes a 24 month forecast for Lake Powell. This forecast includes a minimum, most likely, and maximum hydrology scenarios for the next 24 month period of time. The three scenarios (min, most, and max) are published in January, April, August, and October. The remaining months consist of a most likely hydrology scenario.

The Water Quality Group takes the forecasts and uses them to run the 2 dimensional model, Ce-Qual W2. This model is used to forecast temperatures, TDS, and occasionally DO (Dissolved Oxygen). In FY 2016 (WY 2016), the model has been run each month. The model was also

updated from version 3.2 to version 3.6 and the Meteorological data file was standardized into a reviewed set of historical data. The various regressions (EC to TDS) used for the inflows to Lake Powell have also been updated for the most recent samples sent to the lab.

Colorado River Simulation System (CRSS)

In FY 2016 Reclamation began modeling studies for the 2017 Triennial Review. Reclamation first extended the spreadsheet documenting reported salinity controls through 2016; then worked with USDA and BLM to project salinity controls from 2017-2035 under 4 scenarios. These salinity control scenarios include:

1. No Additional Controls beyond 2017 (1.36M tons control)
2. No Additional Controls beyond 2020 (1.46 M tons control)
3. Controls based on available funding by 2035 (1.68 M tons control)
4. Controlling 1.82M tons by 2035 (1.82M tons control)

Based on these salinity control scenarios preliminary Colorado River Simulation System (CRSS) results were presented to the Salinity Control Forum workgroup. Presented results included average annual flow weighted salinity concentration and the probability of exceeding the numeric criteria at each of the three criteria stations.

Reclamation has worked with CADSWES through FY16 to further enhance the CRSS salinity algorithms. A reach salinity storage user method was added. This method stores and releases reach salt to ensure realistic salinity concentrations are generated within the model at the long term salinity monitoring sites. A multi-layered and -segmented reservoir user method was added to the reservoir objects in RiverWare. The new method will allow Lake Powell to be represented with 2 vertical layers and 3 horizontal segments. Extensive testing indicated including this additional detail provides better agreement with the CE-QUAL-W2 model results but with a simplified framework that can be used for long-term (10-15 year) simulations.

Economic Impacts Model

The Salinity Economic Impact Model (SEIM) estimates economic damages incurred in the lower Colorado River Basin in metropolitan and agricultural areas that receive Colorado River water. The model estimates salinity-caused economic damages for household water-using appliances, equipment and infrastructure used in the commercial, industrial, and water utilities sectors, and losses to agricultural crop production and resultant agricultural revenues. SEIM also estimates additional costs related to meeting state-wide water quality standards for ground water and recycled water use in the Metropolitan Water District (MWD) service area. Economic damages measured by SEIM are based on TDS levels greater than 500 mg/L, the EPA's secondary safe water drinking standard for Total Dissolved Solids.

In FY 2016 Reclamation continued to work with the Salinity Damages Task Force. In early January 2016, Reclamation released a revised Salinity Economic Impacts Model (SEIM) dated 011916. This model included further simplification in model structure as possible and identified remaining data gaps and model structure issues. Reclamation met with the Task Force

January 22 and stepped through the current model structure including the methods for each sector and required data. Members of the sub-committee provided state-level data for the SEIM. Along with providing state-level data for the SEIM, the sub-committee members were tasked with examining and revising the subareas contained within SEIM if needed. The Lower Basin States agreed to continue gathering updated data based on newly identified subareas.

Reclamation met with the Metropolitan Water Board (MWD) on February 22 and September 19 to review and provide comment on proposed Excel based programing to automate and redesign the SEIM interface for a simpler user experience. Reclamation is committed to continuing to work with MWD as this effort progresses.

A scope of work for a consultant contract was finalized during FY16. Several meetings and numerous conference calls were held during FY16 to finalize the scope of work. A Request for Proposals (RFP) is expected to be released to the public in early FY17.

Science Team

To further improve and expand our knowledge of salinity control methods, data, and modeling within the Colorado River basin, the Salinity Science Team was created. This team incorporates technical experts and coordinators from each Federal agency (Reclamation, USDA, NRCS, BLM, and USGS) that provides salinity data and/or modeling and the Forum's Executive Director. For more information on the Science Team, please refer to the last section of the USGS Chapter in the 2006 FAR.

The following are some of the topics that were addressed by the Science Team during meetings held in January and August 2016:

1. Funding/contract update of approved Research, Studies, and Investigations (SIRs)
2. Basinwide Program 2015 FOA
3. Review of Basins assessment ranking discussion; SPARROW II
4. Review of SIR proposals for funding and recommending to the Advisory Council's Technical Advisory Group (TAG) which proposals should receive funding.
5. Update on Paradox Valley Unit Groundwater model and simulations
6. Pah Tempe Study, Desert Lakes Monitoring
7. New areas for salinity studies
8. Economic Damages Model – Matching funds with Reclamation's Southern California Area Office to hire contractor to collect inputs. Solicitation out in early FY17, looking for award in February 2017
9. Future science direction, needs, priorities, and funding

Basinwide Salinity Control Program (Basinwide Program)

Funding Opportunity Announcement (FOA)

Applications to reduce salinity contributions to the Colorado River were solicited through a FOA for both the Basinwide Program and Basin States Program (BSP). The FOA was released on April 27, 2015, and closed on July 17, 2015. Reclamation's Grants Officer received the applications and reviewed for responsiveness to the requirements as described in the FOA. The acceptable applications were forwarded onto an Application Review Committee (ARC) for a detailed review.

Eight of the ten projects selected, totaling about $35 million and controlling over 30,000 tons of salt, have been awarded cooperative agreements through Reclamation's Basinwide Program. The last two agreements are anticipated to be awarded in December 2016. Five projects totaling about $7.5 million and controlling 5,597 tons of salt have been awarded agreements through the BSP by state ag agencies or by Reclamation.

Price – San Rafael River Basins, Utah

Huntington Cleveland Irrigation Company (HCIC) Project (Project): The Project is located in northern Emery County, in and around the towns of Huntington, Lawrence, Cleveland, and Elmo. The Project was selected in the 2004 Request for Proposals (RFP) and awarded a cooperative agreement in September 2004. A new cooperative agreement was executed in November 2006, and was modified again in September 2009. Approximately 350 miles of open earthen canals and laterals are being replaced with a pressurized pipeline distribution system (Distribution System) to accommodate sprinkler irrigation on about 16,000 acres. Funding for this project is being shared between Reclamation's Basinwide Program, HCIC, NRCS's EQIP, the Parallel Program, and Rocky Mountain Power, formally known as Utah Power and Light. The last of Reclamation's share of $17,116,336 for the Off-farm Distribution System was obligated in 2008. Reclamation can provide up to an additional $6,000,000 in funding equally 50/50 with HCIC funds for completion of the Distribution System. Since 2009, Reclamation has provided over $4,000,000 in additional funding. The Project, scheduled to be completed in 2016, will result in the annual reduction of 59,000 reportable tons of salt in the Colorado River at an anticipated cost of approximately less than $100/ton. Of the 59,000 tons of salt, 13,000 are attributed to the Off-Farm Distribution System and 46,000 tons are attributed to the On-Farm Distribution System and the on-farm salinity control measures (sprinklers).

Blue Cut/Mammoth Unit, Cottonwood Creek Consolidated Irrigation Company Salinity Project: The $5,500,000 Blue Cut/Mammoth Unit, Cottonwood Creek Irrigation Company Irrigation Project was selected from the applications received in the 2012 FOA. A cooperative agreement was executed in August 2013. This project will replace approximately 45.6 miles of earthen canals and laterals with a pressurized pipeline system resulting in the reduction of 3,789 reportable tons per year of salt in the Colorado River at an anticipated cost of approximately $67.57 per ton of salt. The pressurized pipeline will serve 5,680 acres resulting in additional on farm salt savings. Pipeline construction was complete as of September 8, 2016. Approximately 35 percent of the served acreage is under contract for on-farm improvements. The recipient continues to add valves and meters as those systems come

online. It will take 2 to 3 more years for NRCS to contract the remainder of the acreage and the last canals can be taken out of service.

Manila-Washam Salinity Area, Utah

South Valley Lateral Salinity Project: This project is located in Daggett County south of the town of Manila, Utah. It was selected from the applications received in the 2012 FOA and was submitted by the Sheep Creek Irrigation Company. A cooperative agreement was executed in May of 2013, for the amount of $4,026,264.75. This project replaced approximately 27,400 feet of earthen laterals with irrigation pipe resulting in the annual reduction of 3,373 reportable tons of salt in the Colorado River at an anticipated cost of approximately $55.57 per ton of salt. The project began in the fall of 2014, and went into service for the 2015 irrigation season ahead of schedule and under budget. The recipient was approved to use unexpended funding to make improvements to their Antelope Wash Lateral. That construction is scheduled to begin late in 2016.

Big Sandy Project, Sweetwater County, in the vicinity of Farson and Eden, Wyoming

Eden Valley, Farson/Eden Pipeline Project: This project was selected in the 2008 FOA.   A Cooperative Agreement was executed in February of 2009, for the amount of $6,453,072. This project will replace approximately 24 miles of earthen laterals with irrigation pipe resulting in the annual reduction of 6,594 reportable tons of salt in the Colorado River at an anticipated cost of approximately $52.57 per ton of salt. Laterals E-7, E-8, and E-13 are completed, and work on the West Side Canal was completed and operational in the spring of 2014. Due to some pipeline leaks the Recipient is withholding retainage funds until the end of the 2016 irrigation season to ensure all leaks have been addressed.

West Blacks Fork Salinity Area, Wyoming

Austin/Wall Off-Farm Irrigation Project: This project is located in Uintah County in the vicinity of Lyman, Wyoming. It was selected from the applications received in the 2012 FOA and was submitted by the Austin/Wall Irrigation District. A cooperative agreement was executed in May 2013, for the amount of $1,350,000. This project will replace approximately 32,000 feet of earthen canal and laterals with irrigation pipe resulting in the annual reduction of 1,092 reportable tons of salt in the Colorado River at an anticipated cost of approximately $57.55 per ton of salt. The project is scheduled to begin construction in the fall of 2016, and be completed in the spring of 2017.

Gunnison Basin, Colorado

Uncompahgre Valley Water Users Association (UVWUA) Phase 7 Project: As a result of the 2010 FOA, the UVWUA was awarded a $3.2 million cooperative agreement for Phase 7 of the East Side Laterals Project (ESL). This phase involves an additional 12.7 miles of laterals under the Selig and East Canal systems and the reduction of about 3,029 tons of salt loading annually. Construction began in the fall of 2012 and was completed in 2016.

UVWUA Phase 8 – ESL: As a result of the 2012 FOA, the UVWUA was selected to be awarded a $3.5 million cooperative agreement for Phase 8 of the ESL. This phase involves an additional 14.1 miles of laterals under the South Canal, East Canal and the Loutzenhizer systems and the reduction of about 3,307 tons of salt loading annually. The cooperative agreement was executed in FY 2014, with construction to begin in the summer of 2015, and continuing through 2017.

Minnesota Canal Salinity Control Piping Project Phase II: Selected in the 2012 FOA, this project involved piping the Minnesota Extension portion of the Minnesota Canal & Reservoir Company (MCRC) existing unlined canals in a tributary to the North Fork of the Gunnison River near Paonia, Colorado. In June of 2013, Reclamation entered into an agreement to provide up to $3.03 million to pipe 3.8 miles of existing canals with an expected salt load reduction of about 2,328 tons/year. Construction began in the fall of 2014 and was completed in the fall of 2015.

Clipper Irrigation Salinity Control – Project 4: Selected in the 2010 FOA, this project involved piping a portion of the Crawford Clipper Ditch existing unlined canals in a tributary to the Cottonwood Creek drainage of the Gunnison River near Hotchkiss, Colorado. In September 2012, Reclamation entered into an agreement to provide up to $1.21 million to pipe 3.5 miles of existing canals with an expected salt load reduction of about 1,427 tons/year. Construction began in 2014 and was completed in the fall of 2015.

Slack/Patterson Laterals Piping Project: Selected in the 2012 FOA, this project involved piping of the Slack and Patterson Laterals portion of the Roger's Mesa Water Distribution Association's existing, unlined laterals supplied by the Fire Mountain Canal and Leroux Creek, a tributary to the North Fork of the Gunnison River near Hotchkiss, Colorado. In June 2013, Reclamation entered into an agreement to provide up to $3.39 million to pipe 9.1 miles of existing laterals with an expected salt load reduction of about 3,345 tons/year. Construction began in the fall of 2014 and was completed in the fall of 2015.

Cattleman's Harts, Hart/McLaughlin, Rockwell, Poulsen Ditches: Selected in the 2012 FOA, this project involved piping a portion of the Cattleman's earthen laterals, operated by the Cedar Canyon Iron Springs Irrigation Company and supplied by Crystal Creek, a tributary to the Gunnison River near Crawford, Colorado. In July 2013, Reclamation entered into an agreement to provide up to $2.01 million to pipe 6.3 miles of existing laterals with an expected salt load reduction of about 1,855 tons/year. Construction began in the fall of 2015 and will be completed in 2018.

Cattleman's Ditch Salinity Control – Phase 2: Selected under the 2015 FOA, the Cedar Canon Iron Springs Ditch and Reservoir Company was awarded a $2.67 million cooperative grant to pipe approximately 6.0 miles of existing, unlined earthen irrigation canal and laterals located near Crawford, Colorado and along Alkali Creek, a tributary to the Gunnison River. This will result in an annual salt load reduction of approximately 2,183 tons to the Colorado River, at a cost effectiveness of $51.00 per ton. The piping project will consist of buried HDPE, PVC, and gravity flow pipe. The cooperative agreement was executed in April 2016, and construction will begin in July of 2017. It is expected to be completed in 2018.

Clipper Center Lateral Pipeline Project: Selected under the 2015 FOA, the Crawford Clipper Ditch Company was awarded a $3.15 million cooperative grant to pipe approximately 4.3 miles of existing, unlined earthen irrigation canals located near Crawford, Colorado and along Cottonwood Creek, a tributary to the Gunnison River. This will result in an annual salt load reduction of approximately 2,606 tons to the Colorado River, at a cost effectiveness of $50.43 per ton. The piping project will consist of buried PVC and HDPE pipe. The cooperative agreement was executed in March 2016, and construction will begin in October of 2017. It is expected to be completed in 2018.

North Delta Canal – Phase 1: Selected under the 2015 FOA, the North Delta Irrigation Company was awarded a $5.56 million cooperative grant to pipe approximately 5.97 miles of existing, unlined earthen irrigation canals located near Delta, Colorado and along the north side of the Gunnison River. This will result in an annual salt load reduction of approximately 4,383 tons to the Colorado River, at a cost effectiveness of $52.92 per ton. The piping project will consist of 1.41 miles of buried HDPE pipe and 3.02 miles of gravity flow pipe (piping is providing a 1.54 mile shortcut). The cooperative agreement was executed in April 2016, and construction will begin in fall of 2017. It is expected to be completed in 2019.

Orchard Ranch Ditch Piping Project: Selected under the 2015 FOA, the Orchard Ranch Ditch Company was awarded a $1.28 million cooperative grant to pipe approximately 2.0 miles of existing, unlined earthen irrigation canals located near Orchard City, Colorado and along Surface Creek, a tributary to the Gunnison River. This will result in an annual salt load reduction of approximately 1,004 tons to the Colorado River, at a cost effectiveness of $53.16 per ton. The piping project will consist of buried HDPE pipe. The cooperative agreement was executed in April 2016, and construction will begin in October of 2017. It is expected to be completed in 2018.

Minnesota L-75 Lateral Salinity Control Project: Selected under the 2015 FOA, the Minnesota L-75 Lateral Company was awarded a $153,412 cooperative grant to pipe approximately 3,100 feet of existing, unlined earthen irrigation ditch located near Paonia, Colorado and along the south side of the North Fork of the Gunnison River. This will result in an annual salt load reduction of approximately 129 tons to the Colorado River, at a cost effectiveness of $49.57 per ton. The piping project will consist of buried PVC pipe. The cooperative agreement was executed in March 2016, and construction will begin in April of 2017. It is expected to be completed in 2017.

Grand Valley, Colorado

Grand Valley Irrigation Company (GVIC) Canal Improvement Grant 2010: As a result of selection under the 2010 FOA, the GVIC was awarded a $2.8 million cooperative grant to line about 1.9 miles of their main canal and pipe about 4,100 ft. of ditch within the Grand Valley. A salt loading reduction of approximately 1,749 tons annually is expected. The canal lining will consist of a PVC membrane with a shotcrete cover and the pipe will be concrete. Construction began in December 2011, and was completed in the spring of 2016.

Grand Valley Irrigation Company (GVIC) Canal Improvement Grant 2012: As a result of selection under the 2012 FOA, the GVIC was selected to be awarded a $4.9 million cooperative grant to line about 2.4 miles of their main canal within the Grand Valley. A salt loading reduction of approximately 4,001 tons annually is expected. The canal lining will consist of a PVC membrane with a shotcrete cover. The cooperative agreement was executed in FY 2014 and construction began in December 2014. It is expected to be completed in 2017.

Grand Valley Irrigation Company 9GVIC) Canal Improvement Grant 2015: Selected under the 2015 FOA, the GVWUA was awarded a $2.8 million cooperative grant to line approximately 1.65 miles of their main irrigation canal within the Grand Valley. This will result in a salt load reduction of approximately 2,363 tons annually at a cost effectiveness of $49.64 per ton. The canal lining will consist of a 30-mil PVC membrane with 3-4 inches of shotcrete cover. The cooperative agreement was executed in August 2016, and construction will begin in November of 2017. It is expected to be completed in 2019.

Grand Valley Water Users Association (GVWUA) Government Highline Canal – Reach 1A Middle: Selected under the 2015 FOA, the GVWUA was awarded a $3.6 million cooperative grant to line approximately 0.97 miles of their main irrigation canal within the Grand Valley. This will result in a salt load reduction of approximately 2,583 tons annually at a cost effectiveness of $58.63 per ton. The canal lining will consist of a 30-mil PVC membrane with 3-4 inches of shotcrete cover. The cooperative agreement was executed in April 2016, and construction will begin in November of 2016. It is expected to be completed in 2018.

Paradox Valley Unit (PVU), Colorado

This project intercepts extremely saline brine (260,000 mg/l total dissolved solids) before it reaches the Dolores River and disposes of the brine by deep well injection (injection interval about 14,000 feet below ground surface).

Induced seismicity and the pressure necessary to inject the brine into the disposal formation at 14,000’ are the limiting factors of the project. As the formation fills with brine, the pressure necessary to inject increases (Table 4). As the pressure increases, the potential for increased seismicity may exist. In January 2013, a M4.4 earthquake occurred that caused Reclamation to modify injection operations which included a new shut down schedule and injection rate

reduction. Those modifications have significantly decreased the injection pressure which has resulted in additional life of the well. Although the current projected life of the well remains at 3 to 5 years, pressure/flow modeling is being conducted to determine the injection well life based on the 2013 injection operation modifications.

The project continues to intercept and dispose of 100,000+ tons of salt annually.

Alternative Study

An Alternative Study/EIS Process to evaluate alternative methods for salt disposal at Paradox is continuing with three alternatives and a "no action" alternative being evaluated. The three action alternatives are a second injection well, evaporation ponds, and brine crystallization technology. These three alternatives and the "no action" alternative are being developed and Reclamation continues to have meetings and discussions on the Alternatives Study/EIS with the BLM, EPA, Colorado Department of Public Health and Environment, and other stakeholders. A draft Alternatives EIS is scheduled to be completed by the end of FY18 with a ROD scheduled to be issued by the end of FY19.

Table 4 – Paradox Well Injection Evaluation

Injection Period	Operational Days[1]	Pressure Start	High Pressure During Period	Injection Period Net Pressure Change	Tons of Salt Injected[2]	No. of Induced Seismic Events	Maximum Magnitude of Induced Seismic Events	Estimated Tons of Salt Entering the River[3]
Jan-May '02[4]	148	1609	4432		52,860	25	2.9	8,469
June-Dec '02[5]	178	929	4593	161	58,953	34	2.2	8,333
Jan-May '03[5]	144	1172	4627	34	53,173	27	2.1	18,037
June-Dec '03[5]	184	1154	4675	48	59,530	106	2.3	11,185
Jan-May '04[6]	140	1201	4640	-35	51,449	47	2.4	20,225
June-Dec '04[7]	160	1091	4541	-99	51,589	57	3.9	6,442
Jan-May '05[5]	140	1038	4736	195	55,024	69	2.4	14,011
June-Dec '05[8]	148	1203	4750	14	46,551	31	2.6	38,582
Jan-June '06[9]	138	375	4680	-70	44,779	10[10]	2.4	53,039

1 Operational days include partial days of operation which accounts for variations in tons of salt injected
2 Tons of salt injected based on 260,000 mg/L. Brine concentration varies slightly due to seasonal and environmental fluctuations.
3 Tons of salt entering the river based on regression equations (Ken Watts, USGS Administrative Report – "Estimates of Dissolved Solids Load of the Dolores River in Paradox Valley, Montrose County, CO, 1988-2009, August 5, 2010"). The 2010 FAR contained erroneous estimated tons of salt entering the river.
4 Begin 100% brine injection
5 No problems
6 Down from 3/1/04 through 3/7/04 for mechanical problems
7 Implemented quarterly 10-day shutdown schedule from 9/22 to 10/22; M3.9 earthquake on 11/7; plant shut down until 11/18; discontinued 10-day shutdown schedule
8 Down from 11/13/05 through 12/31/05 for mechanical problems
9 Down from 1/1/06 through 1/19/06 and 2/16/06 through 3/2/06 for mechanical problems
10 Seismic data for 2006 and the first half of 2007 is likely incomplete due to seismic network problems

July-Dec '06[5]	162	1084	4797	117	56,920	13[10]	2.1	18,605
Jan-June '07[5]	159	1066	4796	-1	56,068	7[10]	1.1	19,728
July-Dec '07[5]	163	1232	4712	-84	57,395	31	2.6	11,279
Jan-June '08[11]	160	1152	4813	101	54,720	47	1.3	15,305
July-Dec '08[5]	162	1263	4822	9	56,734	61	2.1	16,378
*Jan-Mar '09[5]	84	1246	4756	-66	29,163	20	2.6	22,029
Apr-Sept '09[12]	160	1157	4891	135	55,083	70	2.7	16,507
Oct '09-Mar '10[5]	153	970	4930	39	51,589	91	2.9	32,876
Apr '10-Sep '10[5]	162	1347	4990	60	55,747	75	2.7	17,223
Oct '10-Mar '11[5]	161	1378	5000	10	55,501	43	2.9	22,916
Apr '11-Sep '11[13]	158	1276	5102	102	54,422	63	2.7	11,591
Oct '11-Mar '12	162	1282	5115	6	56,531	59	2.5	21,003
Apr '12-Sep '12	161	1417	5108	-7	55,605	116	1.9	5,507

10 Seismic data for 2006 and the first half of 2007 is likely incomplete due to seismic network problems
10 Seismic data for 2006 and the first half of 2007 is likely incomplete due to seismic network problems
11 Down from 4/16-17/08 for mechanical problems
12 Down from 5/18-19/09 for mechanical problems
13 Down from 9/18-9/20 for communication link failure.

* Biannual shutdown schedule changed from winter/summer to spring/fall

2013-2015

Injection Month	Min Injection Pressure	Max Injection Pressure	Monthly Pressure Change	Tons of Salt Injected[1]	Estimated Salt Load in tons[3]	# of Induced Seismic Events[2]	Max Mag of Seismic Events	No. of Seismic Events in Past 12 Months, M ≥ 0.5	Comments
Jan-13	2,733	5,111		8,115	263	15	4.4	69	January 23 M4.4 Earthquake - Shut Plant Down 1/23/13 - 2200 hours; Injection rate prior to earthquake was 230 gpm, shut down schedule was two twenty day shut downs annually
Feb-13	893	2,733	-2,378	0	1,324	3	1.7	70	Plant Down
Mar-13	500	893	-1,840	0	2,600	1	1.2	64	Plant Down
Apr-13	390	4,250	3,357	4,064	3,351	4	0.7	60	Start up on April 17 after January 23 M4.4 earthquake. Begin 33 hour weekly shut down schedule and continue to use 2.125" plungers until new 2" plungers are installed.
May-13	3,290	4,452	202	8,752	1,535	3	1.8	58	33 hour weekly shut down schedule, 2.125" plungers
Jun-13	3,948	4,685	233	8,311	2,089	2	0.8	52	Continued 2.125" plungers to June 5 - Installed 2" plungers on June 5, began 18 hour shut down schedule on June 11
Jul-13	4,143	4,740	55	8,457	1,823	1	1.2	47	No significant down time
Aug-13	4,218	4,722	-18	8,629	289	1	0.5	47	No significant down time
Sep-13	3,513	4,770	48	7,557	659	0	0.3	43	PLC problems - plant down from 9/19 through 9/22. 18 hour weekly shut downs suspended from 9/22 to 11/12
Oct-13	3,683	4,770	0	9,610	195	1	1.2	35	No significant down time
Nov-13	4,208	4,803	33	8,814	577	2	0.7	36	No significant down time
Dec-13	4,195	4,758	36	8,713	778	1	0.8	34	No significant down time

Jan-14	4,202	4,739	-19	8,584	681	0	0.3	19	No significant down time
Feb-14	4,187	4,745	6	7,760	925	4	1.7	20	No significant down time
Mar-14	4,193	4,757	12	8,713	1,275	3	1.5	22	No significant down time
Apr-14	4,206	4,772	15	8,159	675	1	0.9	19	No significant down time
May-14	4,215	4,775	3	8,711	258	2	1.2	18	No significant down time
Jun-14	4,217	4,769	-6	8,381	186	0	N/A	16	No significant down time
Jul-14	4,218	4,778	9	8,428	236	2	2.3	17	No significant down time
Aug-14	4,212	4,781	3	8,645	-300	0	N/A	16	No significant down time
Sep-14	4,206	4,772	-9	8,215	-832	0	1.8	16	No significant down time
Oct-14	4,215	4,776	4	8,773	758	2	1.0	17	No significant down time
Nov-14	4,223	4,773	-3	8,297	2,992	3	1.1	18	No significant down time
Dec-14	4,205	4,778	5	8,272	4,202	0	0.4	17	No significant down time
Jan-15	4,202	4,766	-12	8,731	3,246	2	1.0	19	No significant down time
Feb-15	4,202	4,754	-12	7,775	4,353	2	1.1	17	No significant down time
Mar-15	4,228	4,766	12	8,457	6,282	0	N/A	14	No significant down time
Apr-15	4,196	4,760	-6	8,230	3,959	2	0.6	15	No significant down time
May-15	4,190	4,763	3	8,512	1,708	1	0.7	14	No significant down time
Jun-15	4,209	4,761	-2	8,279	174	2	0.9	16	No significant down time
Jul-15	4,227	4,777	16	8,637	-336	1	1.1	15	No significant down time
Aug-15	4,164	4,797	20	8,614	-478	3	1.6	18	No significant down time
Sep-15	4,239	4,787	-10	8,124	810	2	1.0	20	No significant down time
Oct-15	3,598	4,767	-20	7,863	733	3	0.9	21	SCADA upgrade 10/26-10/29; plant down for 76 hours
Nov-15	4,206	4,737	-30	8,594	2,358	4	1.0	22	No significant down time
Dec-15	4,195	4,754	17	8,494	2,589	1	0.8	23	No significant down time
Jan-16	4,194	4,762	8	8,671	3,227	4	1.6	25	No significant down time
Feb-16	4,133	4,749	-13	7,824	8,965	9	2.1	32	No significant down time
Mar-16	4,214	4,766	17	8,655	5,070	5	1.5	37	No significant down time
Apr-16	4,228	4,773	7	8,367	3,268	2	1.1	37	No significant down time

May-16	4,060	4,774	1	8,655	2,227	4	1.4	40	No significant down time
Jun-16	4,204	4,785	11	8,163	1,868	3	1.4	41	No significant down time
Jul-16	4,233	4,771	-14	8,704	1,136	3	1.4	44	No significant down time
Aug-16	4,242	4,791	20	8,485	-1,275	2	0.7	42	Seismic event count for August may be under-represented
Previous 12 Months			4	100,599	30,976	42	2.1		
Previous 24 Months			19	201,391	57,004	60	2.1		

Basin States Program (BSP)

Public Law 110-246 amended the Act creating the BSP to be implemented by the Secretary of Interior through Reclamation. Section 205(f) of the Act was amended to provide that cost share obligations be met through an up-front cost share from the Basin Funds. The amendment also authorizes Reclamation to expend the required cost share funds through the BSP for salinity control activities established under Section 202(a)(7) of the Act.

Reclamation has determined that agencies within the upper Basin states to be appropriate partners and has executed cooperative agreements to utilize the services of these state agencies to assist in seeking and funding cost-effective activities to reduce salinity in the Colorado River system. Activities will also benefit the upper Basin states by improving water management and increasing irrigation efficiencies. Interagency agreements have been executed with the NRCS in the states of Colorado, Utah, and Wyoming to provide the technical assistance for the BSP.

<u>Utah Department of Agriculture and Food (UDAF)</u>

UDAF received two projects from Reclamation’s 2015 FOA. One project is with Sheep Creek Irrigation Company, Manila, Utah, entitled “Antelope and North Laterals Salinity Project”. This is a canal piping project with two laterals of the Sheep Creek Canal to retain 1,474 tons of salt per year, at a cost of $1,947,929.99. The second project is a rehabilitation project in the Vernal area to pipe the Rock Point Canal, retaining 740 tons of salt. The total project cost is $1,422,849.00, with $976,549.00 coming from Basin States Program (BSP) funds. Grant agreements are in place with Sheep Creek Irrigation Company for the Antelope and North Laterals Salinity Project and Rock Point Irrigation Company for the Rock Point Canal Rehabilitation Project. Both companies have retained engineering firms and have started NEPA processes and are working on final designs.

UDAF, at the direction of the Advisory Council and Reclamation, continues to employ the Uintah Basin Salinity Coordinator, using BSP funds. The value of the coordinator has been demonstrated by the success of his efforts to obtain four 2015 FOA projects. These projects were competitive because of the coordinator’s efforts to confederate historically opposing companies into accepting unified systems that improve each company, as well as the significant cost share match being provided by local funding sources to buy down the cost per ton of salt control. Improvements with the Ute Tribe have also been made. It is anticipated the tribe will submit future FOA’S applications. UDAF feels using BSP funds for this position has greatly benefited the salinity control program in the Uintah Basin area. The coordinator has also been successful in helping entities submit applications with the NRCS Regional Conservation Partnership Programs.

<u>Colorado Department of Agriculture - Colorado State Conservation Board (CSCB)</u>

In Colorado, the Basin States Program (BSP) is delivered through six local Conservation Districts that operate within the boundaries of the approved salinity control areas in the state.

These salinity control areas include the Silt Mesa, Grand Valley, Lower Gunnison, McElmo Creek and Mancos River salinity areas. The Bookcliff, Mesa, Delta, Shavano, High Desert (formerly Dolores), and Mancos Conservation districts receive funds from the Colorado Department of Agriculture (CDA) which receives Financial Assistance (FA) funding based upon a contract agreement with Reclamation.

The projects are planned, designed and certified by NRCS or Conservation District employees. Eleven District employees are paid from BSP Technical Assistance (TA) funding earned by NRCS in Colorado and provided to the Conservation Districts through CDA.

All projects are planned, designed and certified based upon current NRCS Standards and Specifications. Each participant signs an Operation and Maintenance (O&M) agreement to remain in effect for the life of the irrigation and wildlife improvements installed (usually 25 years). Each participant is required to perform proper Irrigation Water Management on the fields in which irrigation improvements were installed. The projects are planned and contracted using the current NRCS EQIP payment schedule.

Applications are competitively screened and prepared by the NRCS. Applications are funded in order of the cost effectiveness. All applications meeting NRCS planning standards that result in an annualized cost per ton of less than $150/ton and that were also not eligible for EQIP are considered for funding depending upon funds available. The cost effectiveness and salt loading data used for these calculations are standardized for all salinity control areas in the state of Colorado by the NRCS.

Progress:

BSP Projects:

Reclamation has provided $6,000,000 in a new funding agreement to Colorado. $1,300,000 has been obligated for five EQIP-like BSP projects and one wildlife habitat replacement project in the Lower Gunnison. These projects will result in cost effectiveness of $101/ton. One project was approved for the Silt project area; 2 projects in the Lower Gunnison project area; and, 3 projects in the Grand Valley project area.

As of the drafting of this report four of the five BSP EQIP ineligible projects are behind schedule, awaiting cultural resource inventories to be completed by NRCS. One pipeline project in the Lower Gunnison was completed in the spring and was fully functional during the 2016 irrigation season. The wildlife habitat replacement project was delayed due to positive identification of federally protected yellow-billed cuckoos within the project area. To mitigate for the presence of this Threatened species, the project will be constructed in two phases with a three-year break separating each phase.

Pending cultural resource clearances, the Duke Ditch will be designed this winter and construction will not take place until fall 2017. Three Grand Valley and one Silt project area pipeline projects are fully designed and applicants are selecting contractors for construction to occur (pending cultural resource clearance) this winter.

Lower Gunnison Basin Salinity Program Coordinator:
The Lower Gunnison Basin Salinity Program Coordinator has become the “go to” resource for off-farm irrigation system improvement projects, assisting interested ditch companies to secure funding for planning and implementing delivery system piping projects, and informing their water users of NRCS Salinity and LGB-RCPP funding available for on-farm improvements. She provided grant application assistance to BSP and Basinwide Salinity Program participants, Conservation Districts, and other ditch companies to complete financing for salinity control related projects. The LGB Salinity Coordinator cost $69,000 per year (salary, benefits and operational costs) and secured over $800,000 of additional funding to support Salinity Program projects.

Grand Valley Wildlife Project:
The Colorado State Conservation Board has contracted with Colorado Parks and Wildlife (CPW) to fund approximately 491 acres of wildlife improvements along the Colorado River in the Grand Valley for a cost of $804,415, utilizing BSP special funding received from Reclamation in 2013. This project completes the Grand Valley wildlife habitat replacement obligation and is nearly finished with one more year of weed control planned. $214,020 has been expended to date. Fifteen thousand dollars will be reserved to perform the remaining tasks and the remaining $389,488 will be de-obligated.

A similar project was recently proposed and approved for state wildlife land in close proximity to the main project. Reclamation obligated $19,000 from the unspent Grand Valley Wildlife Replacement funds to replace future habitat offset obligations.

Ditch Mapping:
Colorado received $34,000 in special BSP funding to complete ditch mapping activities in Ouray County in the Lower Gunnison area, and to review and complete data for ditch mapping previously completed in other portions of the Lower Gunnison area. This project encountered setbacks from landowners that were resistant to allow access to their property and insufficient funds to complete the work. The Colorado Water Conservation Board provided $18,000 to complete the project.

Wyoming Water Development Commission (WWDC)

A new BSP agreement has been put in place with the WWDC that will end in 2020. The new BSP agreement is similar to the agreements with Utah and Colorado. The agreement has a value of $2,800,000 for construction and salinity studies in Wyoming. Projects can either be a FOA pass-off, EQIP pass-off or through a solicitation that meets Reclamation’s requirements.

The WWDC provides state funding through grants and loans for water studies, master plans, and construction projects across Wyoming. WWDC project funding is provided to a public entity for projects including, but limited to, transmission pipelines, storage, reservoirs, irrigation improvements, canal to pipe conversions, and system improvements. Day-to-day operations are managed by the Wyoming Water Development Office (WWDO) staff. The WWDO

construction division will be administering the construction and study components of the Wyoming BSP program.

Progress:

BSP Projects:

Eden Valley, Farson/Eden Pipeline Project:

Currently, WWDC has one BSP project that came through Reclamation's 2015 FOA process. The project is for a canal to pipeline conversion project with the Eden Valley Irrigation and Drainage District (EVIDD). The project will convert approximately 6 miles of irrigation canal to pipeline. The project includes piping the Farson F-2, F-3, F-4 and F-5 laterals. The project budget is $4,390,413 with funding provided by the WWDC of $2,366,000 and the WY BSP of $2,024,413. The project will result in salt control of 1,619 tons and a cost effectiveness of $52.11/ton. Currently, the project has secured the services of an engineer and has entered the design phase of the project. The project is anticipated to be designed, permits secured, necessary reviews conducted and ready for the fall 2017 construction season.

Summary Data
Colorado River Basin Salinity Control Program

The Summary Tables of the Federal Salinity Control Programs are attached in separate pdf files.

Summary of Federal Salinity Control Programs

FY 2016

Salinity Unit		Tons / Year Removed
MEASURES IN PLACE BY RECLAMATION		
Basinwide Program		214,200
Basin States Program (BSP)	1/	16,500
Grand Valley (stage 1 & 2)		122,300
Las Vegas Wash Pitman		3,800
Lower Gunnison-Winter Water		41,400
McElmo Creek "Dolores"		23,000
Meeker Dome		48,000
Paradox Valley	2/	100,900
Reclamation Subtotal		**570,000**
MEASURES IN PLACE BY USDA/BSP	3/	
Big Sandy River		58,300
Grand Valley		143,600
Green River		1,300
Henry's Fork, WY		100
Lower Gunnison		121,000
Mancos		4,500
Manila		8,000
McElmo Creek "Dolores"		29,800
Muddy Creek		100
Price-San Rafael		84,900
Silt		2,300
Uinta Basin		149,000
Tier 2	4/	7,500
USDA Subtotal		**610,000**
MEASURES IN PLACE BY BLM		
Nonpoint Sources	5/	111,600
Well-Plugging		14,600
BLM Subtotal		**126,000**
Measures in Place Total		**1,306,000**
GOALS TO REACH TARGET		
Reclamation Basinwide Program/BSP		190,700
USDA-NRCS Program		183,000
Goals Subtotal		**374,000**
Total (Measures in Place + Goals)		**1,680,000**
Target by 2035	**6/**	**1,680,000**

1/ Off-farm projects funded by Basin States Program (included in following BOR numbers)

2/ Paradox injection well capacity estimated to decline beginning in 2020; assumed continuation of well or alternative control methods after 2020

3/ May include off-farm controls that were not goaled.

4/ Measures in areas outside approved projects

5/ BLM non-point source are estimates.

6/ Based on the 2014 Triennial Review Plan of Implementation

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Upper Colorado River Basin Fund

As of 9/30/2016

A	B	C	D	E	F	G	H	I	J
	Up-front Cost Sharing								
Fiscal Year	Paradox Valley O&M	Grand Valley O&M	McElmo Creek (Dolores) O&M	Lower Gunnison O&M	Basinwide SCP	USDA NRCS BSP	**Total Transfer to UC Region**	**Total Repayment Transfer to Treasury**	**Total Annual Requirement**
1987								6,918	6,918
1988								90,088	90,088
1989								110,531	110,531
1990								156,936	156,936
1991								200,047	200,047
1992								301,475	301,475
1993								451,325	451,325
1994								357,687	357,687
1995								1,934,454	1,934,454
1996								2,750,148	2,750,148
1997					222,505	(254,648)	0	285,643	253,500
1998	65,752	126,103	$26,036	25,622	487,341	131,146	862,000	135,666	997,666
1999	80,561	50,013	21,423	17,195	803,533	244,275	1,217,000	87,604	1,304,604
2000	122,523	42,997	17,817	20,513	773,201	1,611,949	2,589,000	0	2,589,000
2001	104,192	25,425	19,707	20,202	693,579	(863,105)	0	0	0
2002	97,249	49,402	14,879	11,045	738,660	318,765	1,230,000	0	1,230,000
2003	73,375	42,882	23,278	(161)	549,268	271,358	960,000	0	960,000
2004	88,788	37,100	21,859	(89)	613,687	1,200,655	1,962,000	0	1,962,000
2005	95,089	32,359	27,996		529,948	1,256,756	1,942,148	0	1,942,148
2006	90,822	45,863	33,206		544,650	1,469,355	2,183,896	0	2,183,896
2007	98,721	50,252	18,809		574,676 1/	3,274,556	4,017,014 2/	0	4,017,014
2008	135,786	42,183	25,118		513,236	(2,541,323)	(1,825,000)	0	(1,825,000)
2009	117,029	65,919	27,105		1,110,870	4,725,077	6,046,000	0	6,046,000
2010	141,167	38,278	30,396		430,984	1,289,302	1,930,127	0	1,930,127
2011	137,250	51,500	22,114		545,989	801,982	1,558,835	0	1,558,835
2012	121,350	48,336	21,592		533,448	861,682	1,586,408	0	1,586,408
2013	117,199	56,644	25,341		557,908	930,508	1,687,600	0	1,687,600
2014	131,600	70,700	21,536		450,964	1,603,400	2,278,200	0	2,278,200
2015	212,622	94,100	44,293		639,793	1,009,181	1,999,989	0	1,999,989
2016	188,820	119,230	31,050		583,265	1,005,454	1,927,819	0	1,927,819
Subtotal	1,818,453	875,956	398,212	94,327	10,674,447	16,331,690	30,193,085	6,868,522	37,061,607
2017	175,000	75,550	25,714		524,700	820,714	1,621,678	0	1,621,678
2018	150,000	80,000	29,000		538,000	930,070	1,727,070	0	1,727,070
2019	150,000	80,000	25,000		534,000	957,680	1,746,680	0	1,746,680
2020	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2021	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2022	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2023	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2024	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2025	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2026	150,000	80,000	25,000		534,000	804,000	1,593,000	1,384,314	2,977,314
2027	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2028	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2029	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2030	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2031	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2032	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2033	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2034	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2035	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2036	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2037	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2038	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2039	150,000	80,000	25,000		534,000	804,000	1,593,000	3,200,008	4,793,008
2040	150,000	80,000	25,000		534,000	804,000	1,593,000	64,747	1,657,747
2041	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2042	150,000	80,000	25,000		534,000	804,000	1,593,000	347,605	1,940,605
2043	150,000	80,000	25,000		534,000	804,000	1,593,000	158,454	1,751,454
2044	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2045	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
2046	150,000	80,000	25,000		534,000	804,000	1,593,000	1,071,189	2,664,189
2047	150,000	80,000	25,000		534,000	804,000	1,593,000	1,919,584	3,512,584
2048	150,000	80,000	25,000		534,000	804,000	1,593,000	0	1,593,000
Total	4,825,000	2,555,550	804,714	0	17,082,700	4,453,000	4,453,000	8,145,901	96,499,936

1/ In FY2003 $1,103,000 was transferred from the Upper Basin Fund, but was not transferred into the Salinity Program until FY 2007. The total amount was accounted for in the Basinwide Program portion.

2/ The actual amount transferred from the Upper Basin Fund to the UC Region for the Salinity Program was $2,038,000, of which $573,000 was for the Basinwide Program. Please see footnote 1/ for the explanation of the difference.

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Upper Colorado River Basin Fund

As of 9/30/2016

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Repayment																		
				Grand Valley											McElmo Creek			**Total**	
Fiscal	Paradox Valley Unit			Construction Completed								Las Vegas	Lower Gunnison		(Dolores Project)		USDA	**Transfer to**	
Year	Well	Facilities	O&M	Sep-89	Sep-92	Sep-93	Sep-97	Sep-98	Sep-99	Total	O&M	Wash	Construction	O&M	Construction	O&M	NRCS	**Treasury**	Year
1987											2,013						4,905	6,918	1987
1988			973								2,545						86,570	90,088	1988
1989			4,454								914						105,163	110,531	1989
1990			7,190								3,675						146,071	156,936	1990
1991			9,659								4,317					2,269	183,802	200,047	1991
1992			17,701								4,418			10,301		2,321	266,734	301,475	1992
1993			16,011								11,012			11,000		5,230	408,072	451,325	1993
1994			18,457								2,152			15,865		1,917	319,296	357,687	1994
1995			29,749								14,647		1,405,078	16,021		8,845	460,114	1,934,454	1995
1996			90,326								24,860		-7,680	18,525	2,464,892	13,657	145,568	2,750,148	1996
1997			80,337								22,645		675	18,774	21,829	12,613	128,770	285,643	1997
1998			70,676								18,704		-43	19,188	10,658	16,483		135,666	1998
1999													59,331		28,273			87,604	1999
2000																		0	2000
2001																		0	2001
2002																		0	2002
2003																		0	2003
2004																		0	2004
2005																		0	2005
2006																		0	2006
2007																		0	2007
2008																		0	2008
2009																		0	2009
2010																		0	2010
2011																		0	2011
2012																		0	2012
2013																		0	2013
2014																		0	2014
2015																		0	2015
2016																		0	2016
Subtotal	0	0	345,533	0	0	0	0	0	0	0	111,902	0	1,457,361	109,674	2,525,652	63,335	2,255,065	6,868,522	
2017	0	0		0	0	0	0	0	0	0								0	2017
2018	0	0		0	0	0	0	0	0	0								0	2018
2019	0	0		0	0	0	0	0	0	0								0	2019
2020	0	0		0	0	0	0	0	0	0								0	2020
2021	0	0		0	0	0	0	0	0	0								0	2021
2022	0	0		0	0	0	0	0	0	0								0	2022
2023	0	0		0	0	0	0	0	0	0								0	2023
2024	0	0		0	0	0	0	0	0	0								0	2024
2025	0	0		0	0	0	0	0	0	0								0	2025
2026	1,402,063	0		0	0	0	0	0	0	0			-421		-17,328			1,384,314	2026
2027		0		0	0	0	0	0	0	0								0	2027
2028		0		0	0	0	0	0	0	0								0	2028
2029		0		0	0	0	0	0	0	0								0	2029
2030		0		0	0	0	0	0	0	0								0	2030
2031		0		0	0	0	0	0	0	0								0	2031
2032		0		0	0	0	0	0	0	0								0	2032
2033		0		0	0	0	0	0	0	0								0	2033
2034		0		0	0	0	0	0	0	0								0	2034
2035		0		0	0	0	0	0	0	0								0	2035
2036		0		0	0	0	0	0	0	0								0	2036
2037		0		0	0	0	0	0	0	0								0	2037
2038		0		0	0	0	0	0	0	0								0	2038
2039		0		3,200,008	0	0	0	0	0	3,200,008								3,200,008	2039
2040		0			0	0	0	0	0	0		64,747						64,747	2040
2041		0			0	0	0	0	0	0								0	2041
2042		0			347,605	0	0	0	0	347,605								347,605	2042
2043		0				158,454	0	0	0	158,454								158,454	2043
2044		0					0	0	0	0								0	2044
2045		0					0	0	0	0								0	2045
2046		1,071,189					0	0	0	0								1,071,189	2046
2047							209,719	1,059,717	650,148	1,919,584								1,919,584	2047
2048										0									2048
Total	1,402,063	1,071,189	345,533	3,200,008	347,605	158,454	209,719	1,059,717	650,148	5,625,651	111,902	64,747	1,456,940	109,674	2,508,324	63,335	2,255,065	15,014,423	

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Lower Colorado River Basin Development Fund

As of 9/30/2016

A	B	C	D	E		F		G		H	I		J		K		L	M
	Revenues					**Up-front Cost Sharing**												
Year	Hoover	Parker & Davis	**Deficiency Payments**	**Repayment Transfer to Treasury**		Paradox Valley O&M		Grand Valley O&M		McElmo Creek O&M	Lower Gunnison O&M		Basinwide SCP		Actual Transfer NRCS SCP		**Actual and Projected Transfer to UC Region**	**Actual LCRBDF Balance Available**
1987	1,540,705																	$ 1,540,705
1988	9,359,325		1,532,868	56,609														$ 9,310,553
1989	8,442,385		1,532,868	671,012														$ 15,549,058
1990	8,899,348		1,532,868	967,576														$ 21,947,962
1991	8,055,138		11,532,868	2,424,156														$ 16,046,075
1992	7,622,748		1,532,868	3,341,252														$ 18,794,703
1993	6,960,422		1,532,868	5,502,160														$ 18,720,097
1994	8,830,220		1,532,868	7,853,582														$ 18,163,867
1995	8,212,818		1,532,868	5,833,699														$ 19,010,118
1996	9,644,684		1,532,868	4,575,630														$ 22,546,304
1997	9,172,879		1,532,868	1,370,282									1,260,861		1,369,996		3,552,000	$ 25,264,033
1998	10,398,524		1,532,868	2,279,925		372,591		714,585		$147,535	145,192		2,761,600		745,497		4,887,000	$ 26,962,764
1999	10,908,408		730,073	1,180,267		456,513		283,405		121,398	116,000		4,553,355		702,891		6,215,000	$ 29,745,832
2000	10,410,325			1,034,975		694,295		243,648		100,965	237,000		4,381,470		8,246,380		13,783,000	$ 25,338,182
2001	10,255,846			1,034,975		590,422		144,067		111,673	0		3,930,282		(3,790,919)		1,100,000	$ 33,459,054
2002	8,674,271			1,029,973		551,075		279,945		84,315	121,000		4,185,740		1,802,338		6,966,000	$ 34,137,352
2003	8,202,777			1,032,474		415,795		242,999		131,908			3,112,520		6,982,687		10,885,000	$ 30,422,655
2004	8,307,425			1,032,474		503,133		210,236		123,866			3,477,560		6,789,712		11,104,000	$ 26,593,606
2005	6,700,765	448,360		1,032,474		538,836		183,366		158,644			3,003,036		2,697,956		6,581,000	$ 26,129,258
2006	8,174,033	1,462,305		4,901,904		514,658		259,884		188,166			3,086,351		8,349,941		12,399,000	$ 18,464,691
2007	8,008,373	1,418,252		779,905		559,423		284,756		106,582			3,256,500		6,464,739		11,544,000	$ 15,567,410
2008	7,842,785	1,478,287		419,593		769,452		239,037		142,334			2,908,339		6,276,838		10,336,000	$ 14,132,889
2009	7,574,720	1,547,288		997,172	1/	663,166	1/	373,546	1/	153,600		1/	6,294,926	1/	(7,485,238)	1/	0	$ 22,257,725
2010	7,201,523	1,519,805		997,172		799,944		216,909		172,247			2,442,238		1,843,875		5,475,213	$ 24,506,669
2011	7,846,225	1,593,621		997,172		777,750		291,833		125,615			3,093,934		9,948,947		14,237,779	$ 18,711,564
2012	8,154,241	1,552,976		997,172		687,650		273,901		122,357			3,022,866		8,908,532		13,015,306	$ 14,406,303
2013	7,657,120	1,562,447		997,172		664,125		320,988		143,596			3,161,480		8,746,278		12,461,662	$ 10,167,037
2014	7,840,925	1,569,267		0		745,733		400,634		122,035			2,555,465		4,315,185		8,139,052	$ 11,438,178
2015	6,567,522	1,560,024		0		759,674		477,475		146,625			2,656,628	2/	4,290,840		8,331,242	$ 11,234,482
2016	7,260,300	1,575,912		0		1,072,456		640,900		175,950			3,305,165		5,858,581		11,053,052	$ 9,017,643
Subtotal	237,466,478	15,712,631	27,591,621	53,340,757		11,064,235		5,441,214		2,403,461	619,192		63,145,151		77,206,475		161,012,254	
2017	6,972,354	1,575,912		0		991,667		428,117		163,928			2,973,300		5,471,428		10,028,440	$ 7,537,469
2018	7,068,765	1,575,912		0		850,000		453,333		163,928			3,050,528		5,035,428		9,553,217	$ 6,628,930
2019	6,928,527	1,575,912		0		850,000		453,333		163,928			3,023,572		2,737,865		7,228,698	$ 7,904,672
2020	6,813,612	1,575,912		0		850,000		453,333		163,928			3,023,572		2,747,370		7,238,203	$ 9,055,993
2021	6,738,936	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 9,620,842
2022	6,595,221	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 10,041,976
2023	6,507,844	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 10,375,732
2024	6,585,306	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 10,786,951
2025	6,518,259	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 11,131,123
2026	6,435,819	1,575,912		3,438,424		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 7,954,430
2027	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 8,216,162
2028	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 8,477,894
2029	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 8,739,625
2030	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 9,001,357
2031	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 9,263,089
2032	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 9,524,820
2033	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 9,786,552
2034	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 10,048,283
2035	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 10,310,015
2036	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 10,571,747
2037	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 10,833,478
2038	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 11,095,210
2039	6,435,819	1,575,912		10,942,112		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 414,830
2040	6,435,819	1,575,912		198,123		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 478,438
2041	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 740,170
2042	6,435,819	1,575,912		1,166,404		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ (164,502)
2043	6,435,819	1,575,912		304,754		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ (207,525)
2044	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 54,207
2045	6,435,819	1,575,912		0		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ 315,939
2046	6,435,819	1,575,912		4,006,254		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ (3,428,584)
2047	6,435,819	1,575,912		1,895,210		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ (5,062,062)
2048	6,435,819	1,575,912		2,694,352		850,000		453,333		163,928			3,023,572		3,259,167		7,750,000	$ (7,494,682)
Total	446,219,139	66,141,809	27,591,621	77,986,390		38,405,902	0	19,922,654	0	7,649,157	619,192		159,876,139		184,455,242			

1/ Upfront cost sharing was created but not requested by the UC Region this year. Cost Share obligations were met by funds already sitting in the UC Region account, mostly from Unliqiudated Obligations in the Parallel Program.

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Lower Colorado River Basin Development Fund

As of 9/30/2016

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Repayment																		
				Grand Valley															
	Paradox Valley Unit			Construction Completed								Las Vegas	Lower Gunnison		McElmo Creek		USDA	Transfer to	
Year	Well	Facilities	O&M	Sep-89	Sep-92	Sep-93	Sep-97	Sep-98	Sep-99	Total	O&M	Wash	Construction	O&M	Construction	O&M	NRCS	Treasury	Year
1988											11,410				17,402		27,797	56,609	1988
1989			5,511								14,424				160,515		490,562	671,012	1989
1990			25,242	165,039						165,039	5,178				176,194		595,923	967,576	1990
1991			40,744	165,366						165,366	20,826		683,908		685,579		827,733	2,424,156	1991
1992			54,736	167,566						167,566	24,461		1,018,031		1,022,056	12,857	1,041,545	3,341,252	1992
1993			100,304	170,951	30,755					201,706	25,037		1,800,250	58,374	1,791,857	13,151	1,511,481	5,502,160	1993
1994			90,727	170,982	33,049	65,779				269,810	62,403	36,690	1,481,236	62,335	3,508,286	29,635	2,312,460	7,853,582	1994
1995			104,588	170,982	34,063	66,016				271,061	12,198	7,338	1,265,024	89,901	2,263,383	10,861	1,809,345	5,833,699	1995
1996			523,452	318,081	35,023	66,024				419,128	172,501	11,439	151,911	150,538	407,689	97,918	2,641,054	4,575,630	1996
1997			156,978	23,861	35,347	66,033				125,241	51,373	3,237	45,361	45,222	122,133	29,592	791,145	1,370,282	1997
1998			307,790	171,053	35,713	66,038	134,568	313,270		720,642	108,753	7,338	382,343	61,102	616,036	75,921		2,279,925	1998
1999			52,534	171,053	39,952	66,043	134,689	491,475	58,629	961,841	105,987	7,338	-256		52,823			1,180,267	1999
2000				363,811	39,254	17,978	23,822	540,162	40,109	1,025,136		7,338	1,362		1,139			1,034,975	2000
2001				365,715	39,498	18,064	24,536	512,562	64,761	1,025,136		7,338	1,362		1,139			1,034,975	2001
2002				366,384	39,540	18,152	24,053	523,997	57,847	1,029,973								1,029,973	2002
2003				363,833	41,792	17,978	23,822	523,964	53,747	1,025,136		7,338						1,032,474	2003
2004				363,890	39,275	17,978	23,822	521,838	58,333	1,025,136		7,338						1,032,474	2004
2005				363,376	39,276	17,978	23,822	521,921	58,763	1,025,136		7,338						1,032,474	2005
2006	2,655,420	1,214,010		363,376	39,276	17,978	23,822	521,921	58,763	1,025,136		7,338						4,901,904	2006
2007	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338	-383,526		166,259			779,905	2007
2008	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338			-577,579			419,593	2008
2009	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2009
2010	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2010
2011	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2011
2012	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2012
2013	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2013
2014																		0	2014
2015																		0	2015
2016																		0	2016
Subtotal	4,506,780	2,063,817	1,462,606	7,191,269	803,360	593,152	565,252	4,733,008	989,819	14,875,860	614,551	168,774	6,447,006	467,472	10,414,911	269,935	12,049,045	53,340,757	
2017																		0	2017
2018																		0	2018
2019																		0	2019
2020																		0	2020
2021																		0	2021
2022																		0	2022
2023																		0	2023
2024																		0	2024
2025																		0	2025
2026	3,438,424																	3,438,424	2026
2027																		0	2027
2028																		0	2028
2029																		0	2029
2030																		0	2030
2031																		0	2031
2032																		0	2032
2033																		0	2033
2034																		0	2034
2035																		0	2035
2036																		0	2036
2037																		0	2037
2038																		0	2038
2039				10,942,112						10,942,112								10,942,112	2039
2040												198,123						198,123	2040
2041																		0	2041
2042					1,166,404					1,166,404								1,166,404	2042
2043						304,754				304,754								304,754	2043
2044																		0	2044
2045																		0	2045
2046		4,006,254																4,006,254	2046
2047							623,154	1,272,056		1,895,210								1,895,210	2047
2048									2,694,352	2,694,352								2,694,352	2048
Total	7,945,204	6,070,071	1,462,606	18,133,381	1,969,764	897,906	1,188,406	6,005,064	3,684,171	31,878,692	614,551	366,897	6,447,006	467,472	10,414,911	269,935	12,049,045	77,986,390	

SALINITY FUND BALANCE
FISCAL YEAR 2016

	Month	Hoover	Parker-Davis	Total Deposits	Transferred	Cash Balance
	Prior Year Balance					11,234,479.47
	October	1,135,612.50	133,809.48	1,269,421.98	(6,450,052.00)	6,053,849.45
	November	539,787.50	79,235.87	619,023.37		6,672,872.82
	December	480,102.50	96,125.00	576,227.50		7,249,100.32
	January	498,330.00	116,648.90	614,978.90		7,864,079.22
	February	467,155.00	87,610.00	554,765.00		8,418,844.22
	March	525,835.00	97,762.56	623,597.56	(4,603,000.00)	4,439,441.78
	April	619,612.50	160,057.50	779,670.00		5,219,111.78
	May	805,137.50	156,885.00	962,022.50		6,181,134.28
	June	859,215.00	160,052.50	1,019,267.50		7,200,401.78
	July	663,972.50	142,365.00	806,337.50		8,006,739.28
	August	665,540.00	166,925.00	832,465.00		8,839,204.28
*	September		178,435.00	178,435.00		9,017,639.28
		7,260,300.00	1,575,911.81	8,836,211.81	(11,053,052.00)	9,017,639.28

Deposits represent 2.5 Mills Collected.

LOWER COLORADO RIVER BASIN DEVELOPMENT FUND (LCRBDF)
SURCHARGE FUND STATUS (2 1/2 MILLS)

as of 9/30/16

	YEAR	A COLLECTIONS 1/	B COLLECTIONS 4/	C DEFICIENCY PAYMENTS 2/	D SALINITY TRANSFERS TO TREASURY 2/	E SALINITY PAYMENTS UC REGION 2/	(A + B - C - D - E) F CUMULATIVE BALANCE IN LCRBDF V42 FUNDS
	1987	1,540,704.99		0.00	0.00		1,540,704.99
	1988	9,359,325.00		1,532,868.00	56,609.00		9,310,552.99
	1989	8,442,385.00		1,532,868.00	671,012.00		15,549,057.99
	1990	8,899,347.50		1,532,868.00	967,576.00		21,947,961.49
	1991	8,055,137.50		11,532,868.00	2,424,156.00		16,046,074.99
	1992	7,622,747.50		1,532,868.00	3,341,252.00		18,794,702.49
	1993	6,960,422.50		1,532,868.00	5,502,160.00		18,720,096.99
	1994	8,830,220.00		1,532,868.00	7,853,582.00		18,163,866.99
	1995	8,212,818.42		1,532,868.00	5,833,699.00		19,010,118.41
	1996	9,644,684.16		1,532,868.00	4,575,630.00		22,546,304.57
	1997	9,172,878.54		1,532,868.00	1,370,282.00	3,552,000.00	25,264,033.11
	1998	10,398,523.94		1,532,868.00	2,279,925.00	4,887,000.00	26,962,764.05
	1999	10,908,408.29		730,073.25	1,180,267.00	6,215,000.00	29,745,832.09
	2000	10,410,325.45		0.00	1,034,975.00	13,783,000.00	25,338,182.54
3/	2001	10,255,846.46		0.00	1,034,975.00	1,100,000.00	33,459,054.00
	2002	8,674,271.24		0.00	1,029,973.00	6,966,000.00	34,137,352.24
	2003	8,202,776.78		0.00	1,032,474.00	10,885,000.00	30,422,655.02
	2004	8,307,425.37		0.00	1,032,474.00	11,104,000.00	26,593,606.39
	2005	6,700,765.00	448,360.43	0.00	1,032,474.00	6,581,000.00	26,129,257.82
	2006	8,174,032.50	1,462,304.76	0.00	4,901,904.00	12,399,000.00	18,464,691.08
	2007	8,008,372.50	1,418,251.90	0.00	779,905.00	11,544,000.00	15,567,410.48
	2008	7,842,785.00	1,478,286.68	0.00	419,593.00	10,336,000.00	14,132,889.16
5/	2009	7,574,720.00	1,547,287.68	0.00	997,172.00	0.00	22,257,724.84
6/	2010	7,201,522.50	1,519,804.85	0.00	997,172.00	5,475,213.00	24,506,667.19
	2011	7,846,225.00	1,593,620.74	0.00	997,172.00	14,237,779.00	18,711,561.93
	2012	8,154,242.50	1,552,975.78	0.00	997,172.00	13,015,306.00	14,406,302.21
	2013	7,657,120.00	1,562,447.26	0.00	997,172.00	12,461,662.00	10,167,035.47
	2014	7,840,925.00	1,569,266.87	0.00	0.00	8,139,052.00	11,438,175.34
	2015	6,567,522.50	1,560,023.63	0.00	0.00	8,331,242.00	11,234,479.47
	2016	7,260,300.00	1,575,911.81	0.00	0.00	11,053,052.00	9,017,639.28
	TOTALS	237,466,481.14	15,712,630.58	27,591,621.25	53,340,757.00	161,012,254.00	580,569,116.33

1/ Amounts

2/ Payments from LCRBDF

3/ Salinity payment for 2001 was estimated. A trueup was received in 2002 which was $2,501.00 less than was actually paid. Adjusted from 2002 estimate.

4/ Amounts collected into Parker Davis and Transferred to LCRBDF

5/

UC did not request any funds for cost-sharing due to existing & sufficient unliquidated obligations in place

6/

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II
Lower Colorado River Basin Development Fund
Last Revised: 10/21/2016

Preliminary FY 2017 Values

Fiscal Year	Actual/ Projected Fund Revenues	Actual/Projected Federal Expenditure (Basinwide, O&M, EQIP)	Total LCRBDF Required Cost Share	LCRBDF Transfers: Actual/ Projected Transfer to UC Region	LCRBDF Transfers: Repayment to the Treasury	LCRBDF Fund Balance: Actual	LCRBDF Fund Balance: Accrual	LCRBDF Fund Balance: Net
2015	$ 8,127,546	$ 27,160,126	$ 9,543,415	$ 8,331,242	$ -	$ 11,234,479	$ (14,386,421)	$ (3,151,942)
2016	$ 8,836,212	$ 26,969,736	$ 9,382,164	$ 11,053,052	$ -	$ 9,017,639	$ (12,715,533)	$ (3,697,893)
2017	$ 8,528,710	$ 27,922,000	$ 9,765,933	$ 10,010,227	$ -	$ 7,219,744	$ (12,471,239)	$ (5,251,495)
2018	$ 8,625,121	$ 27,891,750	$ 9,788,185	$ 9,553,217	$ -	$ 6,291,648	$ (12,706,207)	$ (6,414,559)
2019	$ 8,484,883	$ 28,247,250	$ 9,917,689	$ 7,228,698	$ -	$ 7,547,833	$ (15,395,198)	$ (7,847,365)
2020	$ 8,369,968	$ 25,850,000	$ 9,044,405	$ 7,238,203	$ -	$ 8,679,598	$ (17,201,400)	$ (8,521,802)
2021	$ 8,295,292	$ 25,850,000	$ 9,044,405	$ 7,750,000	$ -	$ 9,224,890	$ (18,495,804)	$ (9,270,914)

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Appropriations and Cost Share from the Basin Funds 1996 thru 2016

9/30/2016

TOTAL PROGRAM ($1,000)

Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Subtotal	2017	2018	2019
Grand Valley O&M	0	0	3,363	1,333	1,147	677	1,331	1,144	989	863	1,223	1,340	1,125	1,757	1,021	1,373	1,289	1,515	1,885	2,247	2,312	27,935	2,015	2,015	2,015
Paradox Valley O&M	0	0	1,753	2,148	3,267	2,779	2,593	1,957	2,368	2,536	2,423	2,633	3,621	3,121	3,764	3,660	3,236	3,124	3,501	3,575	4,977	57,037	4,667	4,000	4,000
Lower Gunnison O&M	0	0	570	381	456	448	246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,101	0	0	0
McElmo Creek (Dolores) O&M	0	0	579	476	396	439	330	517	486	623	739	419	559	603	676	491	480	563	479	576	459	9,886	643	643	643
USBR Basinwide Program	714	4,944	10,830	17,856	17,181	15,413	16,414	12,206	13,637	11,776	12,103	12,770	11,406	24,686	9,577	12,104	11,854	12,399	10,021	10,419	13,416	261,011	11,660	11,963	11,857
Subtotal (USBR Program)	714	4,944	17,095	22,194	22,446	19,755	20,914	15,824	17,480	15,797	16,487	17,162	16,711	30,167	15,038	17,629	16,860	17,600	15,887	16,816	21,164	357,970	18,984	18,620	18,515
USDA Program	0	4,504	5,446	7,744	7,416	8,264	14,930	18,377	28,093	28,039	28,194	26,466	22,803	23,346	20,833	23,403	22,121	19,077	20,697	21,751	16,844	368,349	20,427	27,014	25,474
BLM (no Basin Funds)	800	800	800	800	800	800	800	800	800	800	751	800	800	800	800	800	800	800	800	800	800	15,951	800	800	800
Total	1,514	10,249	23,340	30,738	30,662	28,820	36,644	35,001	46,373	44,636	45,432	44,428	40,314	54,313	36,671	41,832	39,781	37,477	37,384	39,367	38,808	742,270	40,211	46,435	44,789

APPROPRIATIONS EXPENDED ($1,000)

Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Subtotal	2017	2018	2019
Grand Valley O&M	0	0	2,522	1,000	860	508	998	858	742	647	917	1,005	844	1,318	766	1,030	967	1,133	1,414	1,685	1,734	20,948	1,511	1,511	1,511
Paradox Valley O&M	0	0	1,315	1,611	2,450	2,084	1,945	1,468	1,776	1,902	1,817	1,975	2,716	2,341	2,823	2,745	2,427	2,343	2,626	2,681	3,733	42,778	3,500	3,000	3,000
Lower Gunnison O&M	0	0	399	267	319	314	172	(3)	(1)	(2)	0	0	0	0	0	0	0	0	0	0	0	1,465	0	0	0
McElmo Creek (Dolores) O&M	0	0	405	333	277	307	231	362	340	436	517	293	391	422	473	344	336	394	335	403	321	6,920	450	450	450
USBR Basinwide Program	500	3,461	7,581	12,499	12,027	10,789	11,490	8,544	9,546	8,243	8,472	8,939	7,984	17,280	6,704	8,473	8,298	8,679	7,015	7,293	9,391	183,208	8,162	8,374	8,300
Subtotal (USBR Program)	500	3,461	12,222	15,710	15,933	14,002	14,836	11,229	12,403	11,226	11,723	12,212	11,935	21,361	10,766	12,592	12,028	12,549	11,390	12,062	15,179	255,319	13,623	13,335	13,261
USDA Program	0	3,153	3,812	5,421	5,191	5,785	10,451	12,864	19,665	19,627	19,736	18,526	15,962	16,342	14,583	16,382	15,485	13,354	14,488	15,226	11,791	257,844	14,299	18,910	17,832
Total	500	6,614	16,034	21,131	21,124	19,787	25,287	24,093	32,068	30,853	31,459	30,738	27,897	37,703	25,349	28,974	27,513	25,903	25,878	27,288	26,970	513,163	27,922	32,245	31,093

UPPER BASIN FUND COST SHARE PAYMENTS ($1,000)

Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Subtotal	2017	2018	2019
Grand Valley O&M	0	0	126	50	43	25	50	43	37	32	46	50	42	66	38	52	48	57	71	84	87	1,047	76	76	76
Paradox Valley O&M	0	0	66	81	123	104	97	73	89	95	91	99	136	117	141	137	121	117	131	134	187	2,139	175	150	150
Lower Gunnison O&M	0	0	26	17	21	20	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	0	0	0
McElmo Creek (Dolores) O&M	0	0	26	21	18	20	15	23	22	28	33	19	25	27	30	22	22	25	22	26	21	445	29	29	29
USBR Basinwide Program	32	222	487	804	773	694	739	549	614	530	545	575	513	1,111	431	545	533	558	451	469	604	11,778	525	538	534
Subtotal (USBR Program)	32	222	731	972	977	863	912	689	761	685	715	742	716	1,321	641	756	725	757	675	713	898	15,504	804	793	788
USDA Projects	0	203	245	348	334	372	672	827	1,264	1,262	1,269	1,191	1,026	1,051	937	1,053	995	858	931	979	758	16,576	919	1,216	1,146
Total Payment	32	425	976	1,321	1,311	1,235	1,583	1,516	2,026	1,947	1,983	1,933	1,743	2,371	1,578	1,809	1,720	1,616	1,606	1,692	1,656	32,080	1,723	2,008	1,934

LOWER BASIN FUND COST SHARE PAYMENTS ($1,000)

Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Subtotal	2017	2018	2019
Grand Valley O&M	0	0	715	283	244	144	283	243	210	183	260	285	239	373	217	292	274	325	401	477	491	5,939	428	428	428
Paradox Valley O&M	0	0	373	456	694	590	551	416	503	539	515	560	770	663	800	778	688	664	744	760	1,058	12,120	992	850	850
Lower Gunnison O&M	0	0	145	97	116	114	63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	535	0	0	0
McElmo Creek (Dolores) O&M	0	0	148	121	101	112	84	132	124	159	188	107	142	154	172	125	122	144	122	147	117	2,521	164	164	164
USBR Basinwide Program	182	1,261	2,762	4,553	4,381	3,930	4,186	3,112	3,477	3,003	3,086	3,256	2,908	6,295	2,442	3,087	3,023	3,162	2,555	2,657	3,421	66,740	2,973	3,051	3,024
Subtotal (USBR Program)	182	1,261	4,141	5,511	5,536	4,891	5,167	3,903	4,315	3,884	4,049	4,207	4,060	7,485	3,631	4,281	4,107	4,294	3,822	4,041	5,087	87,856	4,557	4,493	4,466
USDA Projects	0	1,149	1,389	1,975	1,891	2,107	3,807	4,686	7,164	7,150	7,190	6,749	5,815	5,953	5,312	5,968	5,641	4,865	5,278	5,547	4,295	93,929	5,209	6,889	6,496
Total	182	2,409	5,530	7,486	7,427	6,998	8,974	8,590	11,478	11,034	11,239	10,956	9,874	13,438	8,944	10,249	9,748	9,159	9,100	9,587	9,382	181,784	9,766	11,381	10,962

21-Oct-16

FY 2016 Colorado River Basin Salinity Control
On-Farm Program

I. Environmental Quality Incentives Program (EQIP) Financial Assistance (FA) Obligations and Technical Assistance (TA) Expenditures To Approved Projects

	FA	TA	Total
Colorado	$4,979,966	$906,508	$5,886,474
Utah	5,044,294	$685,184	5,729,478
Wyoming	160,814	$14,474	175,288
TOTALS	**$10,185,074**	**$1,606,166**	**$11,791,240**

II. Cost Share Available from Basin States Program (Bureau of Reclamation)

Cost Share on NRCS FA **$4,365,032**

		FA	TA	Total
Colorado				
	State Board	1,280,563		
	NRCS		768,338	
	Reclamation		85,371	
				2,134,271
Utah				
	UDAF	1,297,104		
	NRCS		778,263	
	Reclamation		86,474	
				2,161,840
Wyoming				
	St. Engineer	41,352		
	NRCS		24,811	
	Reclamation		2,757	
				68,920
TOTALS		2,619,019	1,746,013	4,365,032

Cost Share on NRCS TA ***$688,357***

Total Cost Share from Basin Funds ***$5,053,389***

salinity/2016/2016 Interim EQIP FA,TA, No CTA, 10% of TA for BOR

FUNDING FORCAST FOR THE BASINWIDE PROGRAM

Date as of **10/21/2016**

						FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Contract Name	**Contract Amount**	**Obligated to Date**	**Balance To Obligate**	**Expended to Date**	**Balance to Expend**	**Apporopriations & Cost Share + 15% End of year**	**Apporopriations & Cost Share + 15% End of year**	**Apporopriations & Cost Share + 15% End of year**	**Apporopriations & Cost Share + 15% End of year**	**Apporopriations & Cost Share + 15% End of year**
Grand Valley - Canal Improvement (A) 2010	$ 2,819,228	$ 2,819,228	$ -	$ 2,743,235	$ 75,993	$ 397,928				
UVWUA East Side Laterals Project Phase 8	$ 3,542,157	$ 3,542,157	$ -	$ 1,440,260	$ 2,101,897	$ 1,747,157				
Cattelman's - Cedar Canyon, Iron Springs	$ 2,007,225	$ 1,991,798	$ 15,427	$ 1,697,831	$ 293,967	$ 719,154				
GVIC Canal Improvement 2012	$ 4,581,825	$ 3,450,000	$ 1,131,825	$ 191,270	$ 1,370,968	$ 1,880,000	$ 1,131,825			
Blue Cut/ Mammoth Unit	$ 5,500,000	$ 5,326,191	$ 173,809	$ 4,213,768	$ 1,112,423	$ 2,295,074				
Huntington Cleveland Project Continuation	$ 909,913	$ 216,293	$ 693,620	$ 170,970	$ 45,323	$ 210,000	$ -			
FOA - Project 2015	$ 5,363,078	$ -	$ 5,363,078	$ -		$ -	$ 1,200,000	$ 2,000,000	$ 1,521,619	$ 641,459
San Juan Dineh	$ 4,835,391	$ -	$ 4,835,391	$ -		$ 2,200,000	$ 1,565,257	$ 1,070,134		
Clipper Center Lateral Project	$ 3,153,410	$ 410,551	$ 2,742,859	$ -	$ 410,551	$ 410,551	$ 1,500,000	$ 1,242,859		
GVIC - Canal Lining Phase 4	$ 2,814,499	$ -	$ 2,814,499	$ -		$ 73,000	$ 353,000	$ 1,246,000	$ 1,142,499	
Ashley Upper and Highline Canals Project	$ 3,514,847	$ -	$ 3,514,847	$ -		$ 287,500	$ 735,000	$ 1,650,000	$ 477,347	
Cattleman's Ditch Phase 2	$ 2,671,305	$ 111,000	$ 2,560,305	$ -	$ 111,000	$ 111,000	$ 1,065,000	$ 1,495,305		
Orchard Ranch Ditch Piping Project	$ 1,280,720	$ 155,412	$ 1,125,308	$ -	$ 155,412	$ 155,412	$ 1,125,308			
FOA - Project 2015	$ 2,954,512	$ -	$ 2,954,512	$ -		$ -	$ 500,000	$ 1,375,000	$ 1,079,512	
North Delta Canal - Phase 1	$ 5,564,809	$ 129,717	$ 5,435,092	$ -	$ 129,717	$ 714,717	$ 1,500,000	$ 2,250,000	$ 350,092	
Government Highline Canal – Reach 1A Middle	$ 3,634,242	$ 625,000	$ 3,009,242	$ -	$ 625,000	$ 1,375,000	$ 1,000,000	$ 434,242		
	$ 55,147,161	**$ 18,777,347**	**$ 36,369,814**	**$ 10,457,333**	**$ 6,432,252**	**$ 12,576,493**	**$ 11,675,390**	**$ 12,763,540**	**$ 4,571,069**	**$ 641,459**
CONTRACT COSTS						**$ 12,576,493**	**$ 11,675,390**			
NON-CONTRACT COSTS						**$ 384,935**	**$ 400,000**			
TOTAL OPEN AGREEMENTS						**$ 12,961,428**	**$ 12,075,390**			
Appropriations S10						**$ 8,423,000**	**$ 8,162,000**			
Cost Share X10						**$ 3,609,857**	**$ 3,498,000**			
Additional Appropriations S10						**$ 650,000**	**$ 297,715**			
Additional Cost Share X10						**$ 278,571**	**$ 127,592**			
TOTAL						**$ 12,961,428**	**$ 12,085,307**			
Appropriations/Cost Share Totals						**$ 12,961,428**	**$ 12,085,307**	**$ -**	**$ -**	**$ -**
Contract/Non Contract Totals						**$ 12,961,428**	**$ 12,075,390**	**$ -**	**$ -**	**$ -**
						$ (0)	**$ 9,917**	**$ -**	**$ -**	**$ -**

Funding Forecast BasinStates Program

Date as of 10/21/2016

FUNDING FORECAST BASIN STATES PROGRAM

Contract Number	Contract Name	End Date	Contract Amount	Obligated to Date	9315000 Balance To Obligate	Expended to Date	Balance to Expend	FY 2015 Obligations	FY 2016 Obligations	FY 2017 Obligations	FY 2018 Obligations	FY 2019 Obligations	FY 2020 Obligations
R15PG00008	NRCS COLORADO	**9/30/2019**	$ 4,926,760	$ 1,959,228	$ 2,967,532	$ 1,281,987	$ 677,241	$ 985,352	$ 973,876	$ 768,338	$ 1,000,000	$ 900,000	$ 900,000
R13PG40026	NRCS UTAH	**3/31/2018**	$ 5,146,031	$ 4,497,477	$ 648,554	$ 3,274,961	$ 1,222,516	$ 700,000	$ 859,967	$ 648,554	$ 800,000	$ 700,000	$ 700,000
R15PG00011	NRCS WYOMING	**3/2/2020**	$ 121,434	$ 79,106	$ 42,328		$ 79,106	$ 24,595	$ 54,511	$ 24,811	$ 24,533	$ 25,218	$ 26,000
R16AC00001	State of Colorado	**3/1/2021**	$ 6,000,000	$ 1,300,000	$ 4,700,000		$ 1,300,000		$ 1,300,000	$ 75,000	$ 900,000	$ 700,000	$ 700,000
R12AC40018	State of Colorado	**4/17/2017**	$ 5,960,000	$ 5,960,000	$ -	$ 4,040,520	$ 1,919,480	$ 2,500,000	$ 626,600				
R16AC00023	State of Utah	**4/30/2021**	$ 6,237,000	$ 700,000	$ 5,537,000		$ 700,000		$ 700,000	$ 1,600,000	$ 500,000	$ 500,000	$ 500,000
R12AC40019	State of Utah	**9/30/2016**	$ 7,325,000	$ 5,400,000	$ 1,925,000	$ 4,573,289	$ 626,665	$ 975,000	$ 700,000				
R15AC00054	State of Wyoming	**5/30/2020**	$ 2,800,000	$ 310,000	$ 2,490,000	$ 5,907	$ 304,093	$ 10,000	$ 300,000	$ 1,100,000	$ 900,000	$ -	$ -
R14PG00069	US F&WS (3024)	**9/7/2019**	$ 567,374	$ 318,095	$ 249,279	$ 208,910	$ 109,185	$ -	$ -	$ 61,473	$ 63,166	$ 65,000	$ 67,000
526070	Barnett Intermountain - Salinity Consultant	**8/31/2016**	$ 534,769	$ 534,769	$ -	$ 526,070	$ 8,699	$ 110,750					
R16PC00098	Barnett Intermountain - Salinity Consultant	**8/31/2021**	$ 597,900	$ 114,000	$ 483,900	$ 9,500	$ 104,500	$ -	$ 114,000	$ 116,600	$ 120,000	$ 122,100	$ 125,200
R12PC40009	University of Colorado -Prairie	**8/31/2017**	$ 250,000	$ 250,000	$ -	$ 200,000	$ 50,000	$ 6,250	$ 6,250				
NEW	University of Colorado -Prairie									$ 7,000	$ 9,000	11000	$ 13,000
R16AC00019	Minnesota L-75	**9/30/2020**	$ 153,412	$ 153,412	$ -	$ 25,864	$ 127,548		$ 153,412				
R16AC00046	Uinta - White Rocks/Mosby	**12/31/2018**	$ 2,412,463	$ 220,000	$ 2,192,463	$ -	$ 220,000		$ 220,000	$ 1,375,000	$ 815,463		
R11AC40025	Uncompahgre Eastside Lateral Phase 7	**12/30/2016**	$ 3,183,983	$ 2,958,983	$ 225,000	$ 2,944,883	$ 14,100	$ 1,383,983					
R15PD00074	EVAP Ponds CRB	**2/4/2016**	$ 103,540	$ 103,540	$ (0)	$ 101,083	$ 2,457	$ 103,540					
R15PG00123	SIR15-1 MOD1&2 Effects of Vegetation Treatment	**9/30/2018**	$ 221,613	$ 221,613	$ -	$ 85,423	$ 136,190	$ 223,719					
R15PG00125	SIR15-2 USGS Salinity loading from groundwater	**9/17/2017**	$ 81,605	$ 81,605	$ -	$ 43,006	$ 38,599	$ 81,605					
R15PG00126	SIR15-3 USGS Stream Chemistry	**9/30/2018**	$ 233,400	$ 233,400	$ -	$ 113,252	$ 120,148	$ 233,400					
R15PG00127	SIR15-4 USGS Watershed Characteristics	**9/2/2016**	$ 64,000	$ 64,000	$ -	$ 63,462	$ 538	$ 64,000					
R15PG00128	SIR15-6 USGS/BOR Assessment of Regression Models	**9/27/2017**	$ 112,777	$ 112,777	$ -	$ 112,777	$ -	$ 112,777					
In House	SIR15-7 BOR Desert Lakes Monitoring	**9/30/2016**	$ 48,000	$ 48,000	$ -	$ 29,451	$ 18,549	$ 31,998					
R13PG40010	SIR13 14 15 Desert Seep Wash	**3/20/2017**	$ 123,215	$ 123,215	$ -	$ 123,215	$ -	$ -	$ 56,143				
NEW	SIR16 Desert Seep Wash		$ 29,725							$ 29,725			
NEW	SIR Salinity Economic Impact Model (SEIM)		$ 300,000		$ 300,000	$ -				$ 150,000			
In House	SIR 3-2016 Desert Lakes Monitoring		$ 27,628	$ 27,628	$ -	$ -			$ 27,628				
R16PG00131	SIR 4-2016 Enhancements 20 station network	**8/31/2017**	$ 38,500	$ 38,500	$ -	$ -			$ 38,500				
R16PG00132	SIR 5-2016 Pah Tempe Springs Hydrogeology	**9/14/2018**	$ 220,690	$ 220,690	$ -	$ -			$ 220,690				
NEW	SIR Projects in Future				$ -	$ -				$ 320,275	$ 350,000	$ -	$ -
	Reclamation T/A				$ -			$ 12,243	$ 100,000	$ 100,000	$ 100,000	$ 50,000	$ 50,000
	Advisory Member's Travel				$ -		$ -	$ 8,599	$ 9,000	$ 9,000	$ 9,000	$ 11,000	$ 11,000
R13PD40066	RiverWareIDIQ				$ -		$ -	$ 18,000	$ 18,000	$ 18,000	$ 18,000	$ 20,000	$ 20,000
	Streamgaging Contracts w/ USGS				$ -		$ -	$ 340,990	$ 107,750	$ 110,000	$ 113,300	$ 116,700	$ 120,000
	Non Contract Costs							$ 69,701					
					$ -	$ -							
Costs	**Contract/Non Contract Totals**		**$ 43,590,069**	**$ 24,761,819**	**$ 18,798,525**	**$ 17,137,103**	**$ 7,137,852**	**$ 7,996,502**	**$ 6,586,327**	**$ 6,513,776**	**$ 5,722,462**	**$ 3,221,018**	**$ 3,232,200**
Funding	**Upper Basin Cost Share**							**$ 731,386**	**$ 978,846**	**$ 758,008**	**$ 771,428**	**$ 483,153**	**$ 484,830**
Funding	**Lower Basin Cost Share based on NRCS FA**							**$ 3,850,000**	**$ 5,546,792**	**$ 4,295,381**	**$ 4,371,428**	**$ 2,737,865**	**$ 2,747,370**
Funding	**TOTAL UPPER & LOWER BASIN FUNDING**							**$ 4,581,386**	**$ 6,525,638**	**$ 5,053,389**	**$ 5,142,856**	**$ 3,246,780**	**$ 3,232,200**
Funding	**Carryover Basin Funds**							**$ 3,220,864**	**$ 92,902**	**$ 554,000**	**$ 90,000**		
Funding	**From Recovery**							**$ 287,154**		**$ 775,000**			
Funding	**From Accrual**								**$ 300,000**	**$ 150,000**	**$ 664,000**		
Funding	**ALL FUNDING TOTAL**							**$ 8,089,404**	**$ 6,918,540**	**$ 6,532,389**	**$ 5,896,856**	**$ 3,246,780**	**$ 3,232,200**